

Orbit comparison : GFZ (SLCCI) versus COMBINED (Reaper)

Study variable	GFZ orbit (SLCCI)
Reference variable	COMBINED orbit (Reaper)
Missions	ERS-1 (<i>e1</i>), ERS-2 (<i>e2</i>)
Period	[15636, 19540]

Creation date : 2011/09/06

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Study overview

In this study, the GFZ orbit developed in the frame of sea-level CCI project has been compared to the REAPER orbit solution (combined solution derived from ESOC, GFZ and DEOS orbit center productions) to calculate the ERS-2 and ERS-1 sea-level height (SSH).

The impact of using these both orbits on the SSH calculation has been analyzed for ERS-1 and ERS-2 missions :

- for ERS-1 : from October 1992 (cycle 15) to June 1996 (Cycle 53)
- for ERS-2 : from May 1995 (cycle 1) to July 2003 (Cycle 85)

The GFZ SLCCI orbit solution is available on the ftp site : <ftp://ftp.esa-sealevel-cci.org/Data/WP2200/>. The orbit was computed in the ITRF2008 reference frame using the models defined in 1Sergei Rudenko and Tilo Schoene. Definition of common standards for ERS-1, ERS-2, Envisat, TOPEX/Poseidon, Jason-1 and Jason-2 precise orbit determination. Report for the ESA Climate Change Initiative Sea Level Project. April 15, 2011, updated on May 16, 2011.

The COMBINED orbit solutions have been uploaded from the following ftp site: <ftp://dgn6.esoc.esa.int/reaper/>. The orbits are computed in the LPOD2005 terrestrial reference frame using the models and input data described in the poster presentation "Improvements in ERS-1 and ERS-2 precise orbit determination" by S. Rudenko, M. Otten, P. Visser, R. Scharroo and T. Schoene, presented at the European Geosciences Union (EGU) General Assembly 2011, Vienna, Austria, 3-8 April 2011 and available as file ftp://dgn6.esoc.esa.int/reaper/poster_EGU-2011.pdf (S. Rudenko, M. Otten, P. Visser, R. Scharroo, T. Schoene, New improved homogeneous orbits of ERS-1 and ERS-2 satellites, Advances in Space Research, 2011, submitted).

All the validation diagnostics displayed in this report has been performed in agreement with the Sea-Level CCI Product Validation Plan (PVP).

Diagnostic A001 (mission e1)	
Name : Temporal evolution of differences between both altimetric components	
Input data : Along-track altimetric components	
Description : The temporal evolution of global statistics (mean, variance, slope) of differences between 2 different standards of a same altimetric component (sea surface height correction, altimeter parameter, orbit) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) . These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.	
<div><div><div>Mean of GFZ orbit - COMBINED orbit</div><div>Mission e1, cycles 15 to 53</div><div><div>20304050</div><div>Mean = 0.1979Slope = 0.334 mm/yr</div><div>0.40.30.20.10.0</div><div>1993199419951996</div></div></div><div><div>Standard deviation of GFZ orbit - COMBINED orbit</div><div>Mission e1, cycles 15 to 53</div><div><div>20304050</div><div>Mean = 1.383</div><div>321</div><div>1993199419951996</div></div></div></div>	

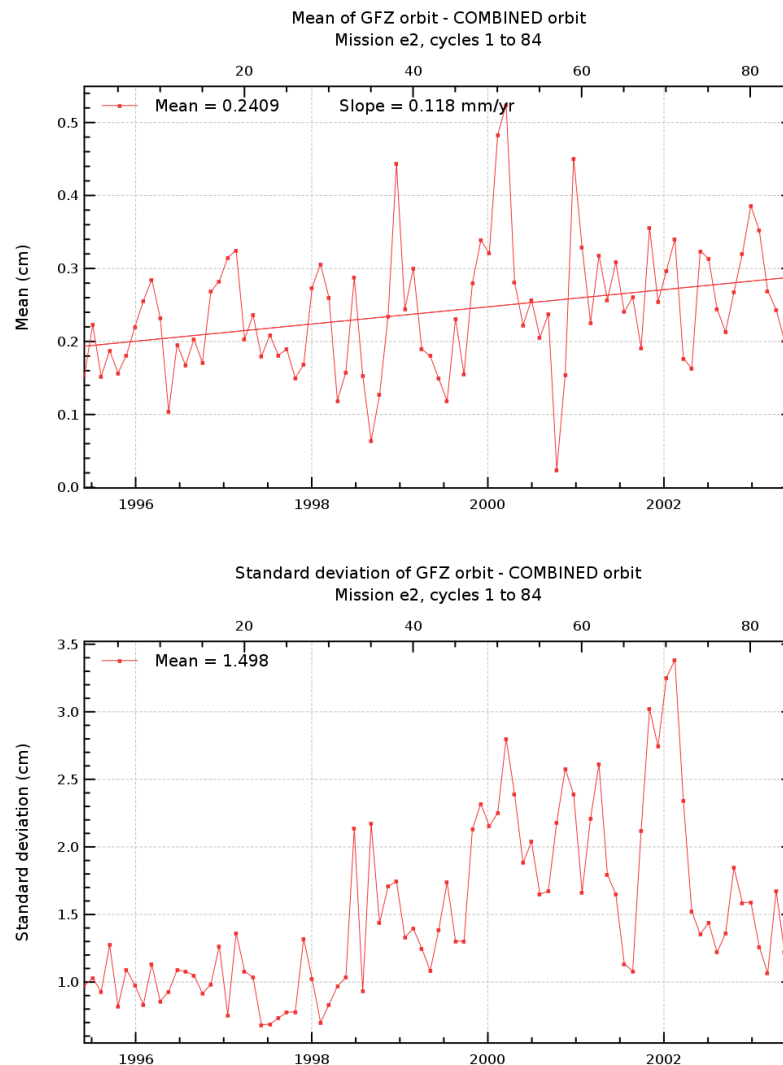
Diagnostic A001 (mission e2)

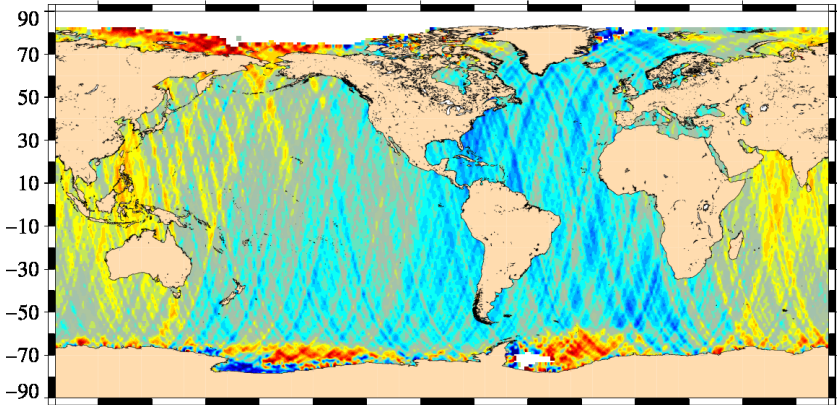
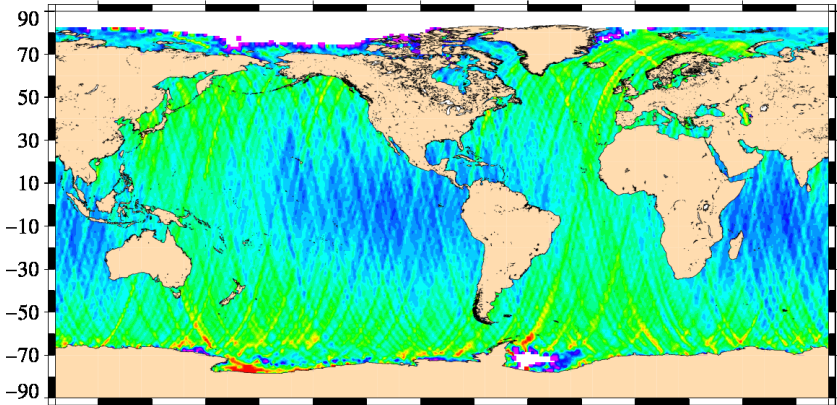
Name : Temporal evolution of differences between both altimetric components

Input data : Along-track altimetric components

Description : The temporal evolution of global statistics (mean, variance, slope) of differences between 2 different standards of a same altimetric component (sea surface height correction, altimeter parameter, orbit) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) . These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses



Diagnostic A002 (mission e1)	
Name : Map of differences between both altimetric components over all the period	
Input data : Along-track altimetric components	
Description : The map of global statistics (mean, standard deviation) of differences between 2 different standards of a same altimetric component (sea surface height correction, altimeter parameter, orbit) are calculated over a given period which is the longer as possible to have obtain reliable statically results. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.	
<div>Mean of GFZ orbit – COMBINED orbit</div> <div>Mission e1, cycles 15 to 53</div> <div></div> <div>-0.778302-0.175404 0.427494 1.030392</div> <div>Mean (cm)</div> <div>Standard deviation of GFZ orbit – COMBINED orbit</div> <div>Mission e1, cycles 15 to 53</div> <div></div> <div>0.23672 0.92683 1.61693 2.30703</div> <div>Standard deviation (cm)</div>	

Diagnostic A002 (mission e2)

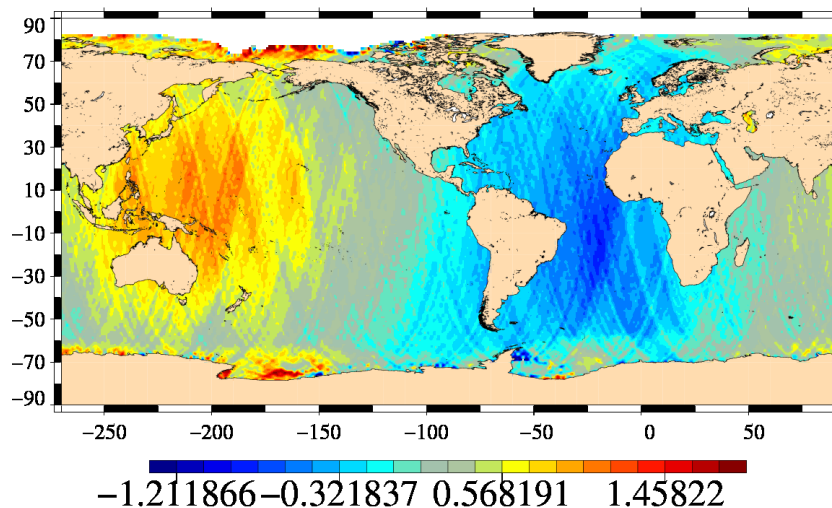
Name : Map of differences between both altimetric components over all the period

Input data : Along-track altimetric components

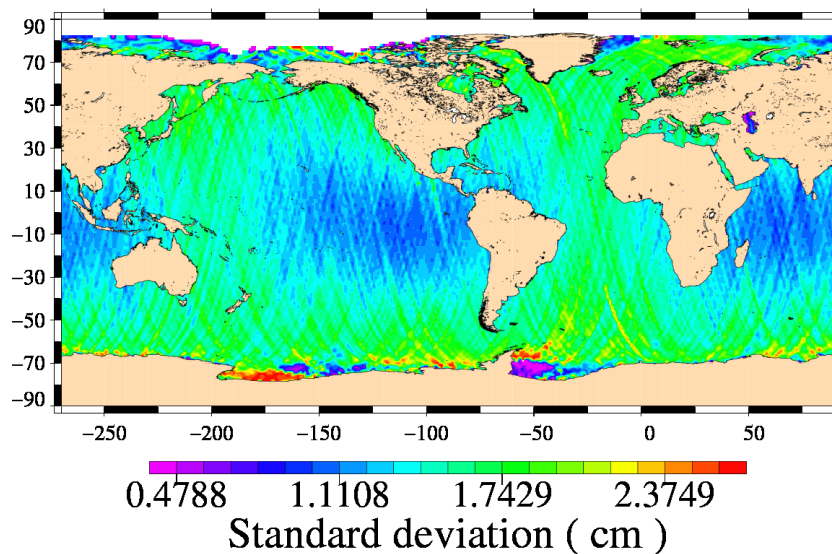
Description : The map of global statistics (mean, standard deviation) of differences between 2 different standards of a same altimetric component (sea surface height correction, altimeter parameter, orbit) are calculated over a given period which is the longer as possible to have obtain reliable statically results. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

Mean of GFZ orbit – COMBINED orbit
Mission e2, cycles 1 to 84



Mean (cm)
Standard deviation of GFZ orbit – COMBINED orbit
Mission e2, cycles 1 to 84

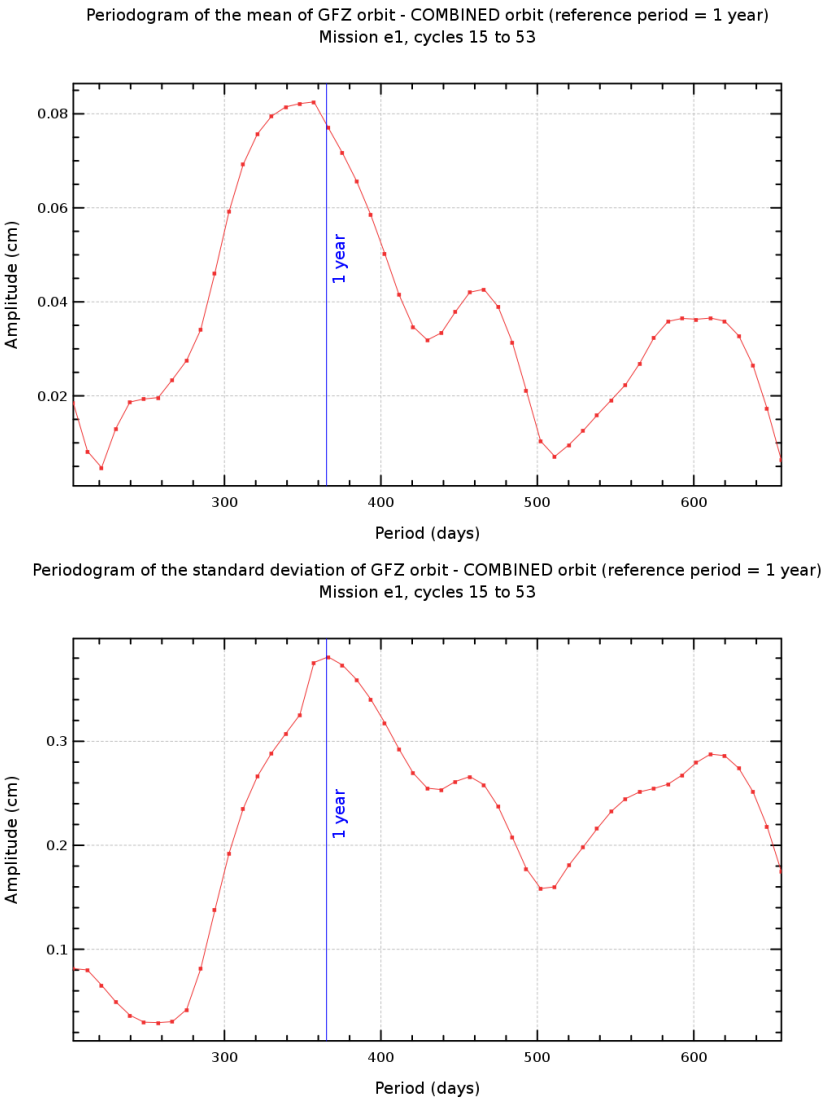


Diagnostic A003_a (mission e1)

Name : Periodogram derived from temporal evolution of altimetric component differences

Input data : Along-track altimetric components

Description : The periodogram derived from temporal and global altimetric component differences is calculated from cycle by cycle monitoring of altimetric component differences (derived from diagnostic A001). It is calculated from the mean or the variance differences. The Periodogram can be calculated for all the periods, but it can be focused on a dedicated period.



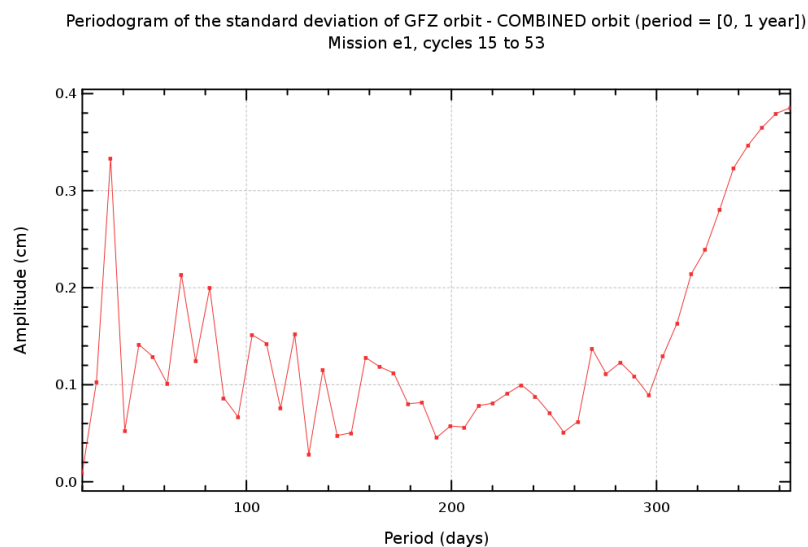
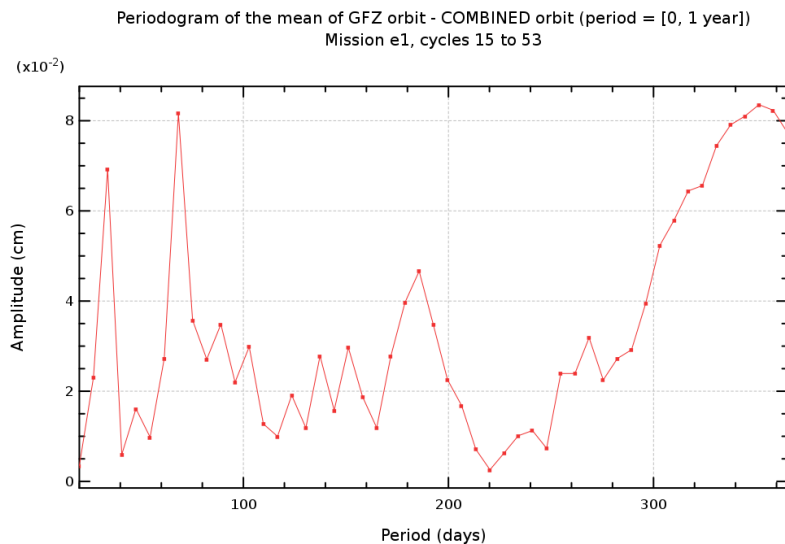
Diagnostic A003_b (mission e1)

Name : Periodogram derived from temporal evolution of altimetric component differences

Input data : Along-track altimetric components

Description : The periodogram derived from temporal and global altimetric component differences is calculated from cycle by cycle monitoring of altimetric component differences (derived from diagnostic A001). It is calculated from the mean or the variance differences. The Periodogram can be calculated for all the periods, but it can be focused on a dedicated period.

Diagnostic type : Global internal analyses



Diagnostic A003_a (mission e2)

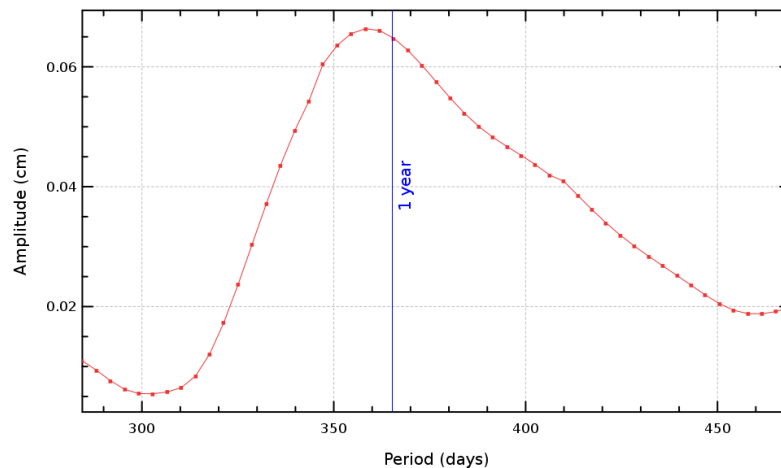
Name : Periodogram derived from temporal evolution of altimetric component differences

Input data : Along-track altimetric components

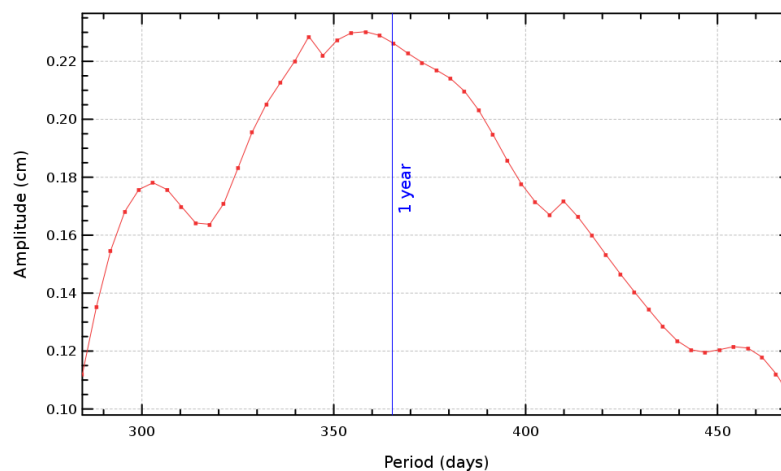
Description : The periodogram derived from temporal and global altimetric component differences is calculated from cycle by cycle monitoring of altimetric component differences (derived from diagnostic A001). It is calculated from the mean or the variance differences. The Periodogram can be calculated for all the periods, but it can be focused on a dedicated period.

Diagnostic type : Global internal analyses

Periodogram of the mean of GFZ orbit - COMBINED orbit (reference period = 1 year)
Mission e2, cycles 1 to 84



Periodogram of the standard deviation of GFZ orbit - COMBINED orbit (reference period = 1 year)
Mission e2, cycles 1 to 84



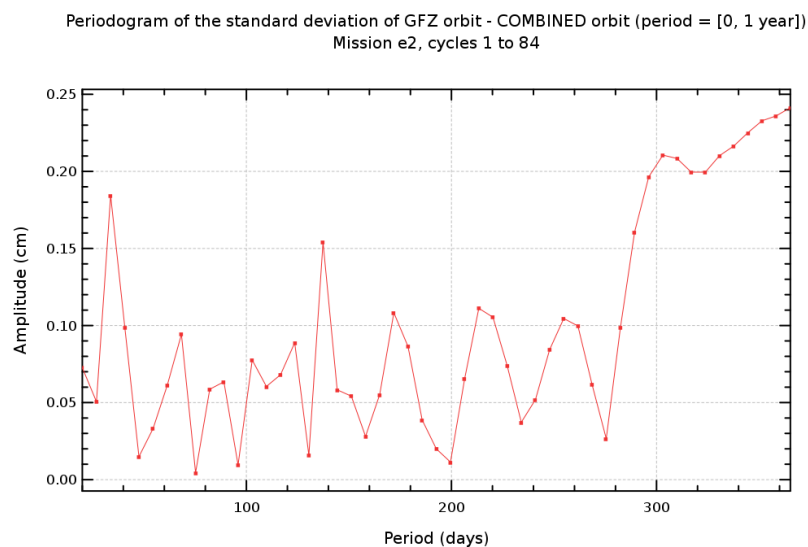
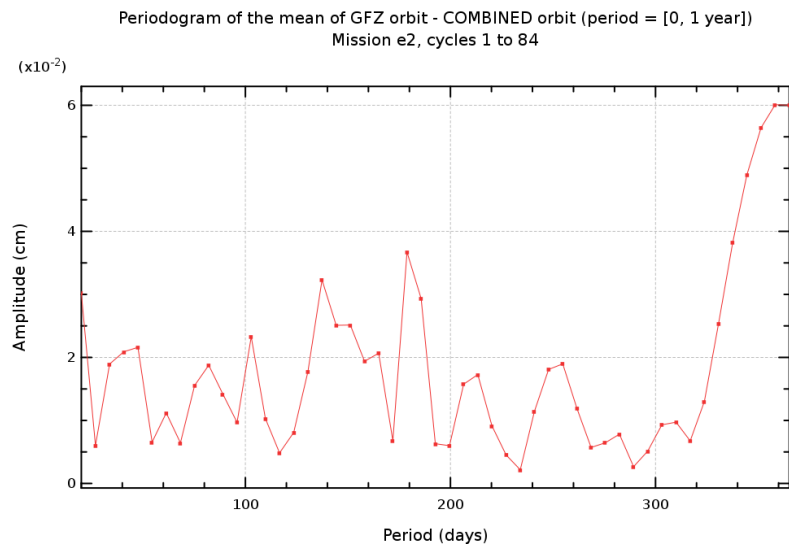
Diagnostic A003_b (mission e2)

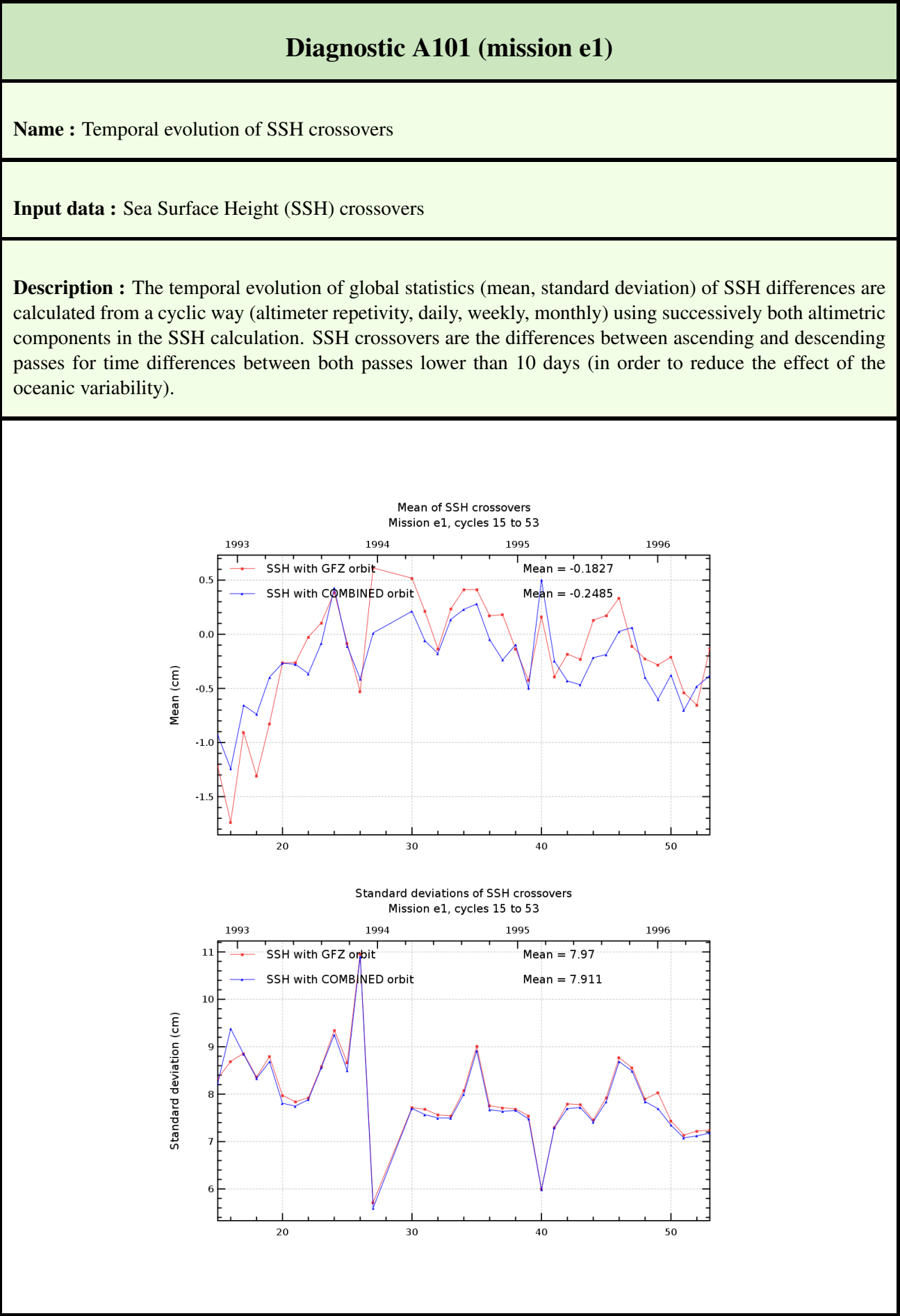
Name : Periodogram derived from temporal evolution of altimetric component differences

Input data : Along-track altimetric components

Description : The periodogram derived from temporal and global altimetric component differences is calculated from cycle by cycle monitoring of altimetric component differences (derived from diagnostic A001). It is calculated from the mean or the variance differences. The Periodogram can be calculated for all the periods, but it can be focused on a dedicated period.

Diagnostic type : Global internal analyses





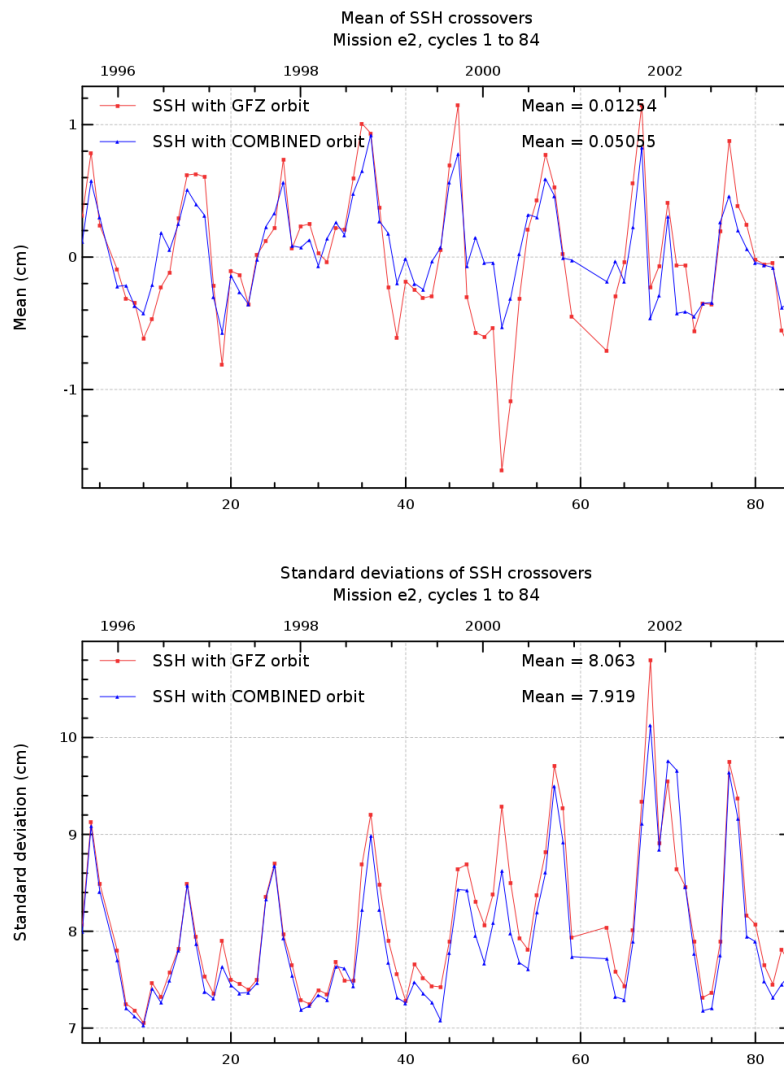
Diagnostic A101 (mission e2)

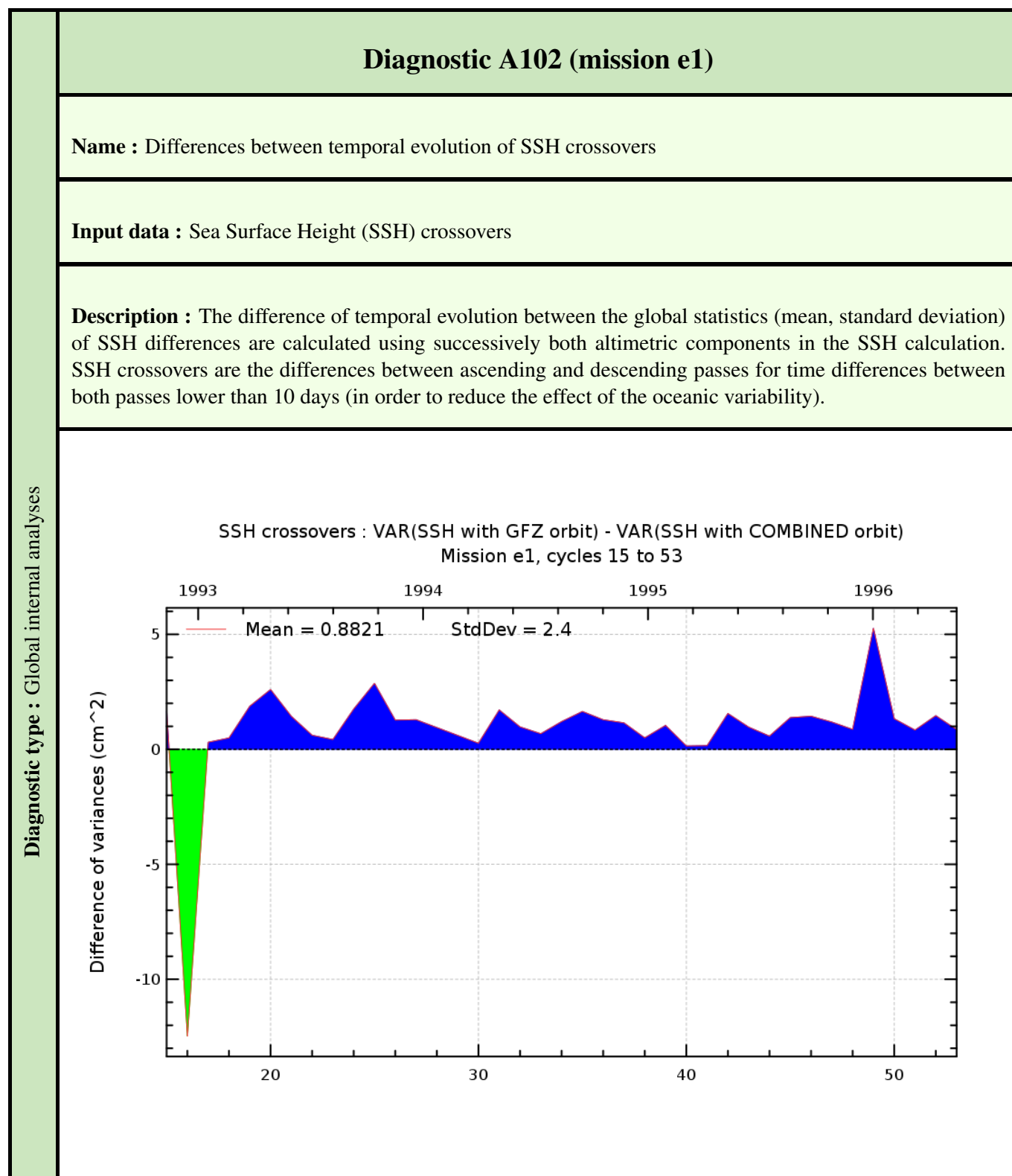
Name : Temporal evolution of SSH crossovers

Input data : Sea Surface Height (SSH) crossovers

Description : The temporal evolution of global statistics (mean, standard deviation) of SSH differences are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

Diagnostic type : Global internal analyses





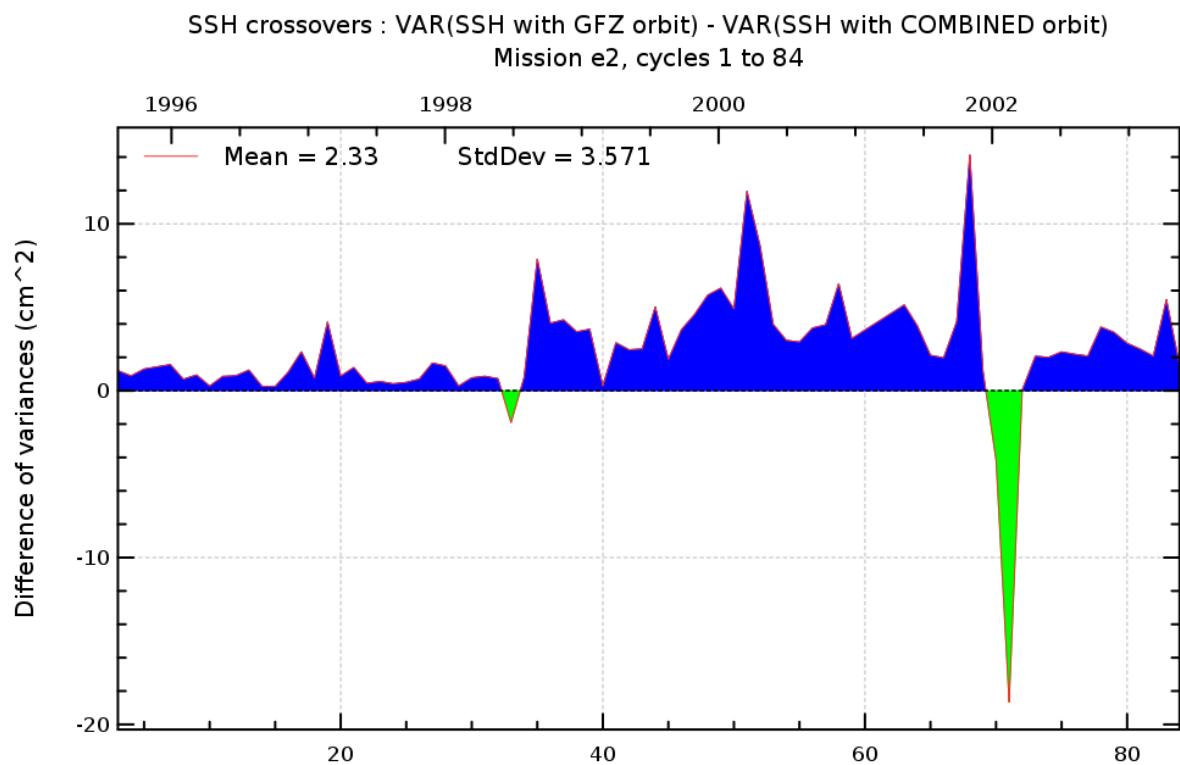
Diagnostic A102 (mission e2)

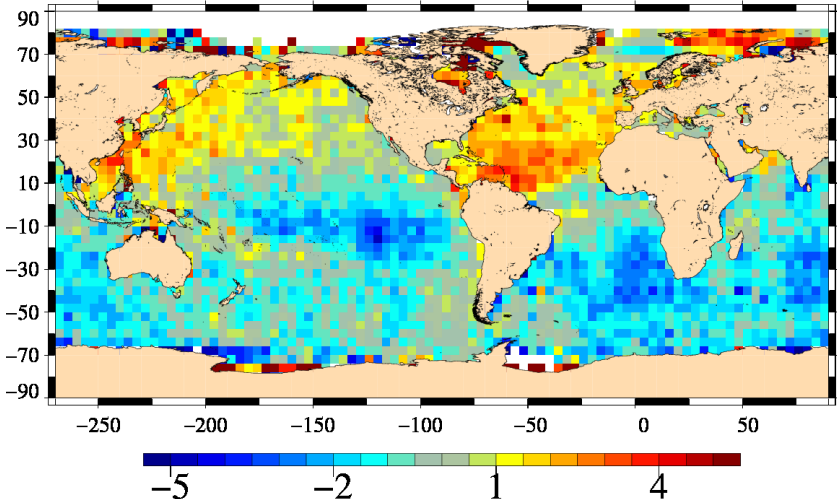
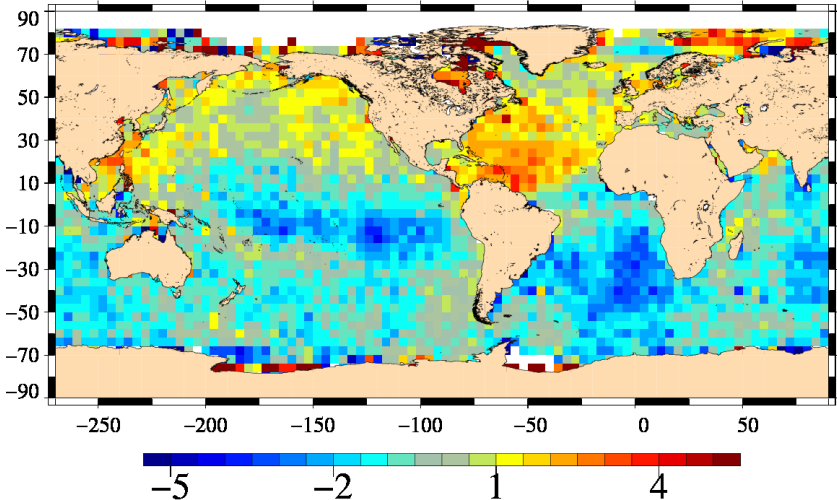
Name : Differences between temporal evolution of SSH crossovers

Input data : Sea Surface Height (SSH) crossovers

Description : The difference of temporal evolution between the global statistics (mean, standard deviation) of SSH differences are calculated using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

Diagnostic type : Global internal analyses



Diagnostic A103 (mission e1)	
Name : Map of SSH crossovers	
Input data : Sea Surface Height (SSH) crossovers	
<p>Description : The differences between maps of SSH crossovers differences (mean, variance) are calculated using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).</p>	
<div><div>Mean of SSH with GFZ orbit Mission e1, cycles 15 to 53</div><div>Mean (cm)</div><div>Mean of SSH with COMBINED orbit Mission e1, cycles 15 to 53</div><div>Mean (cm)</div></div>	

Diagnostic A103 (mission e2)

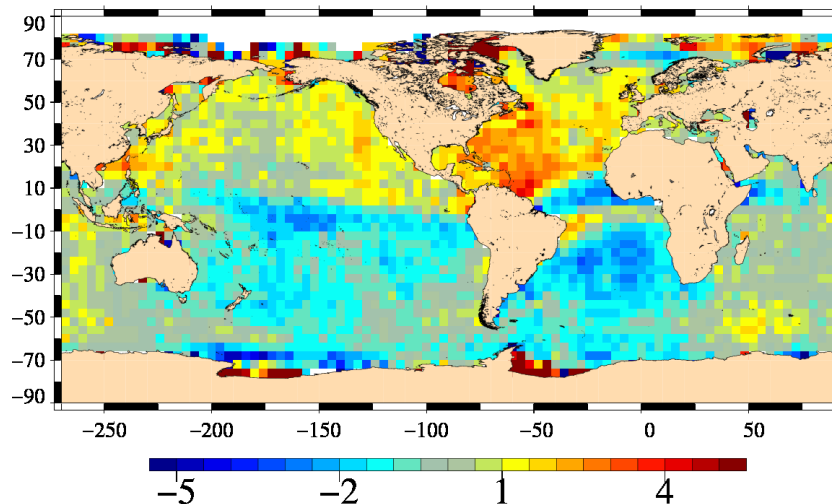
Name : Map of SSH crossovers

Input data : Sea Surface Height (SSH) crossovers

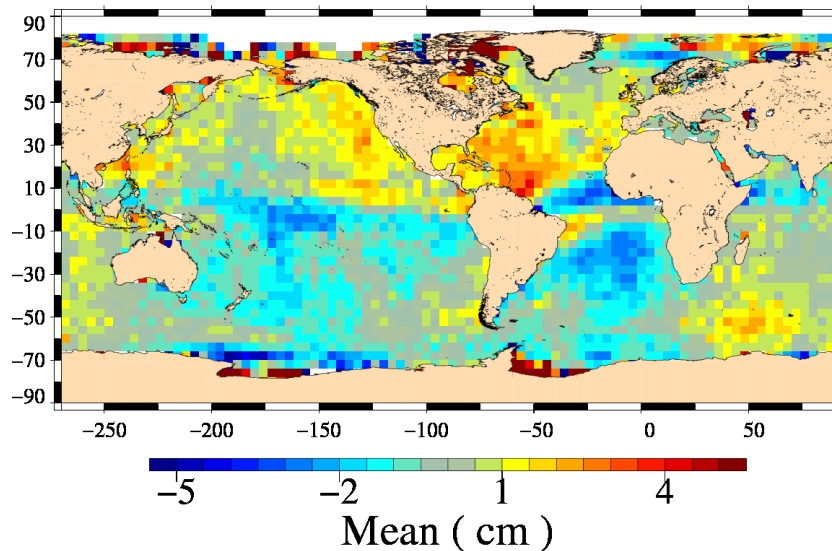
Description : The differences between maps of SSH crossovers differences (mean, variance) are calculated using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

Diagnostic type : Global internal analyses

Mean of SSH with GFZ orbit
Mission e2, cycles 1 to 84



Mean (cm)
Mean of SSH with COMBINED orbit
Mission e2, cycles 1 to 84



Diagnostic A104 (mission e1)

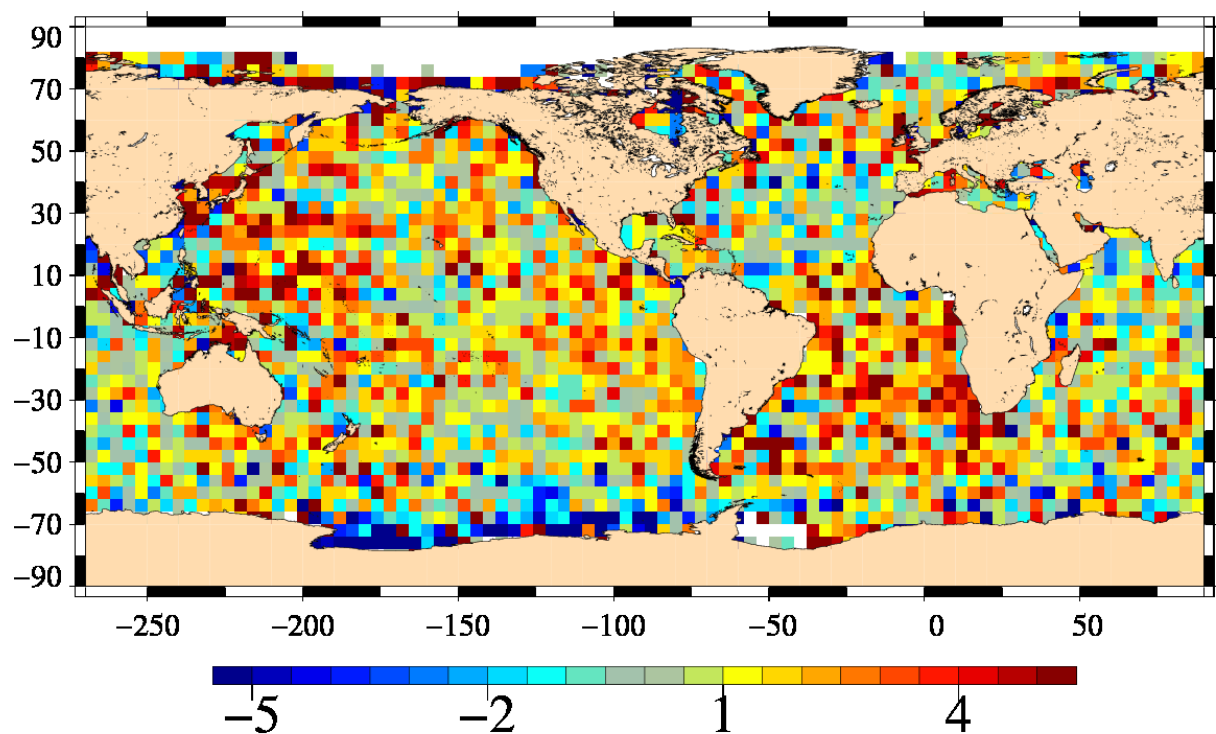
Name : Differences between maps of SSH crossovers

Input data : Sea Surface Height (SSH) crossovers

Description : The differences between maps of SSH crossovers (derived from diagnostic A103) are calculated from the SSH crossover differences (mean, standard deviation) using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

Diagnostic type : Global internal analyses

VAR(SSH with GFZ orbit) – VAR(SSH with COMBINED orbit)
Mission e1, cycles 15 to 53



SSH crossovers : difference of variances (cm^2)

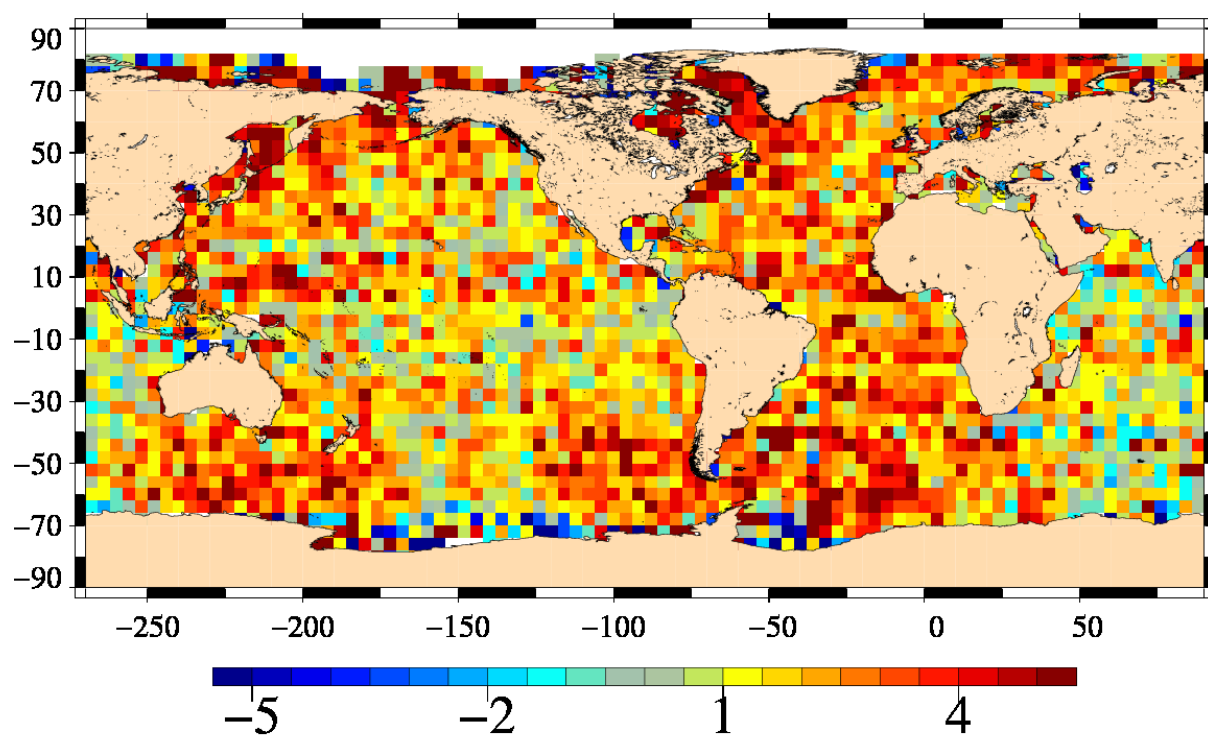
Diagnostic A104 (mission e2)

Name : Differences between maps of SSH crossovers

Input data : Sea Surface Height (SSH) crossovers

Description : The differences between maps of SSH crossovers (derived from diagnostic A103) are calculated from the SSH crossover differences (mean, standard deviation) using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

VAR(SSH with GFZ orbit) – VAR(SSH with COMBINED orbit)
Mission e2, cycles 1 to 84



SSH crossovers : difference of variances (cm²)

Diagnostic type : Global internal analyses	Diagnostic A201_a (mission e1)																																								
	Name : Temporal evolution of Sea Level Anomaly (SLA)																																								
	Input data : Along track SLA																																								
	<p>Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.</p>																																								
	<div>Global MSL Mission e1, cycles 15 to 53</div> <p>The graph displays the temporal evolution of Sea Level Anomaly (SLA) statistics for Mission e1, cycles 15 to 53. The Y-axis represents Mean (cm) from 41 to 44. The X-axis represents Mission cycles from 15 to 53, with corresponding years 1993, 1994, 1995, and 1996. Two data series are plotted: SLA with GFZ orbit (red line with markers) and SLA with COMBINED orbit (blue line with markers). Both series show a clear upward trend. Linear regression lines are fitted to the data, with the GFZ orbit showing a steeper slope (7.23 mm/yr) compared to the COMBINED orbit (6.95 mm/yr). The L.S.R. (Least Squares Residual) for both is 0.6.</p> <table><tr><th>Mission Cycle</th><th>Year</th><th>SLA with GFZ orbit (cm)</th><th>SLA with COMBINED orbit (cm)</th></tr><tr><td>15</td><td>1993</td><td>41.5</td><td>41.5</td></tr><tr><td>20</td><td>1993</td><td>41.8</td><td>41.8</td></tr><tr><td>25</td><td>1993</td><td>42.2</td><td>42.2</td></tr><tr><td>30</td><td>1994</td><td>42.5</td><td>42.5</td></tr><tr><td>35</td><td>1994</td><td>42.8</td><td>42.8</td></tr><tr><td>40</td><td>1995</td><td>43.2</td><td>43.2</td></tr><tr><td>45</td><td>1995</td><td>43.5</td><td>43.5</td></tr><tr><td>50</td><td>1996</td><td>43.8</td><td>43.8</td></tr><tr><td>53</td><td>1996</td><td>44.0</td><td>44.0</td></tr></table>		Mission Cycle	Year	SLA with GFZ orbit (cm)	SLA with COMBINED orbit (cm)	15	1993	41.5	41.5	20	1993	41.8	41.8	25	1993	42.2	42.2	30	1994	42.5	42.5	35	1994	42.8	42.8	40	1995	43.2	43.2	45	1995	43.5	43.5	50	1996	43.8	43.8	53	1996	44.0
Mission Cycle	Year	SLA with GFZ orbit (cm)	SLA with COMBINED orbit (cm)																																						
15	1993	41.5	41.5																																						
20	1993	41.8	41.8																																						
25	1993	42.2	42.2																																						
30	1994	42.5	42.5																																						
35	1994	42.8	42.8																																						
40	1995	43.2	43.2																																						
45	1995	43.5	43.5																																						
50	1996	43.8	43.8																																						
53	1996	44.0	44.0																																						

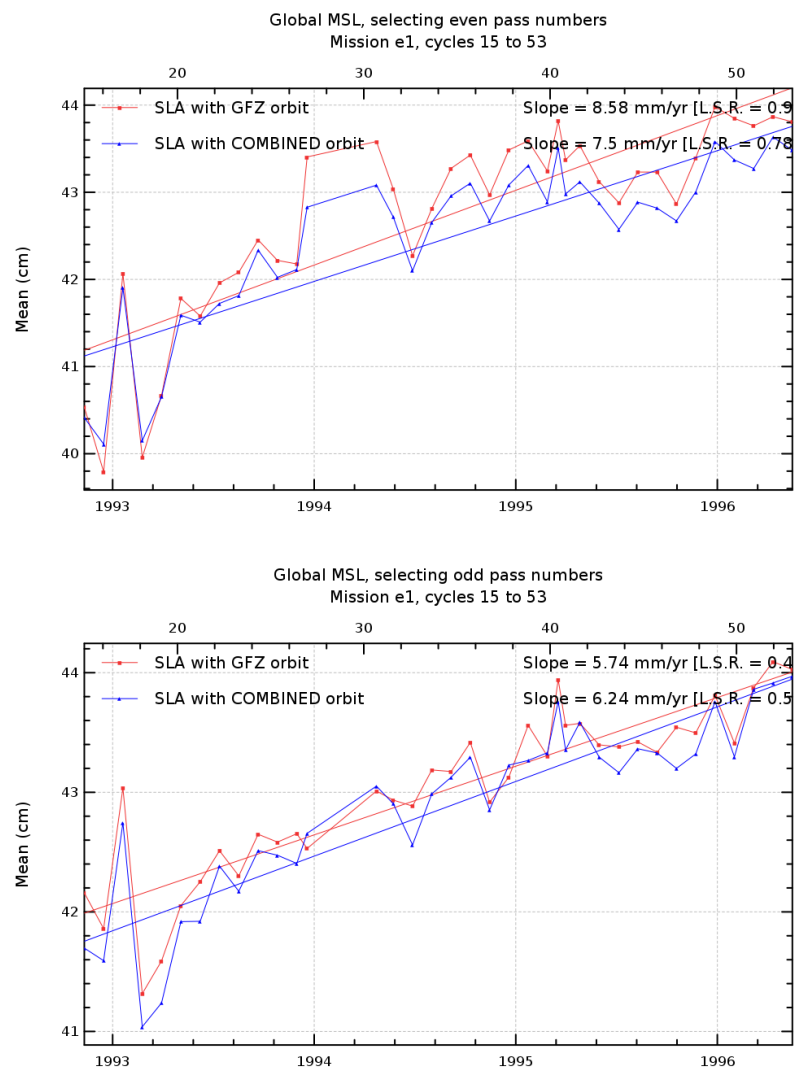
Diagnostic A201_b (mission e1)

Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses



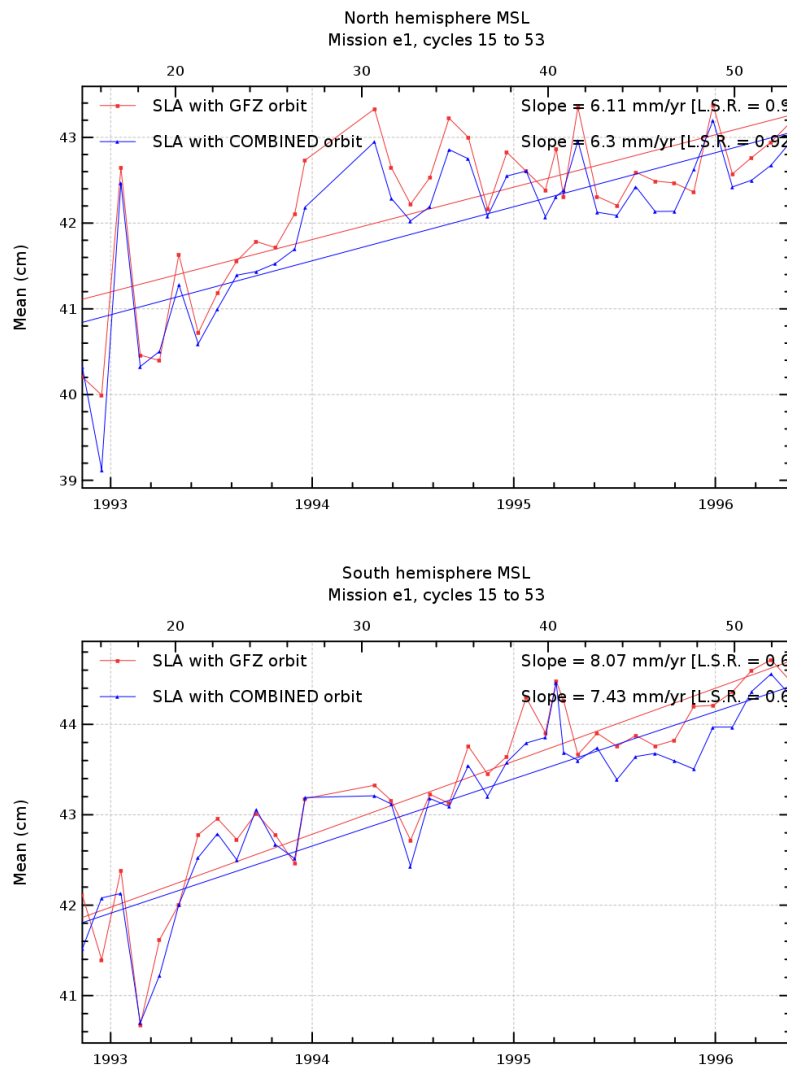
Diagnostic A201_c (mission e1)

Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses



Diagnostic A201_d (mission e1)

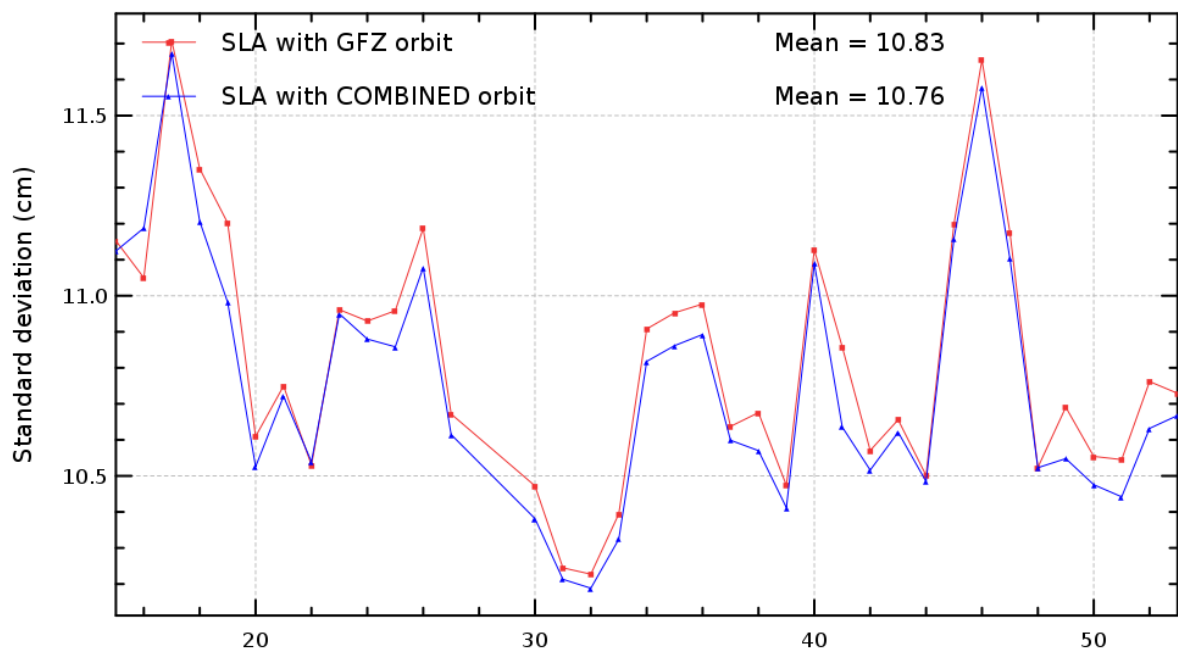
Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses

Global MSL
Mission e1, cycles 15 to 53



Diagnostic A201_e (mission e1)

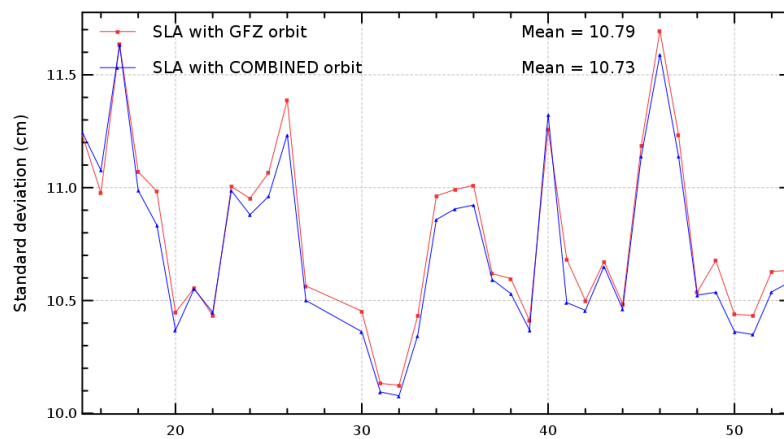
Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

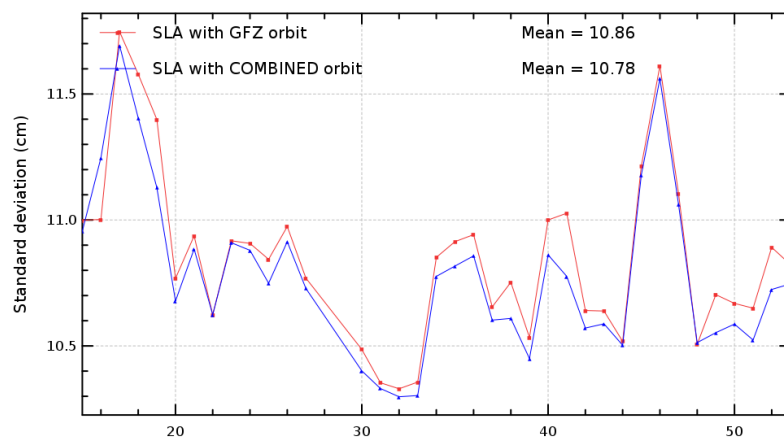
Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses

Global MSL, selecting even pass numbers
Mission e1, cycles 15 to 53



Global MSL, selecting odd pass numbers
Mission e1, cycles 15 to 53



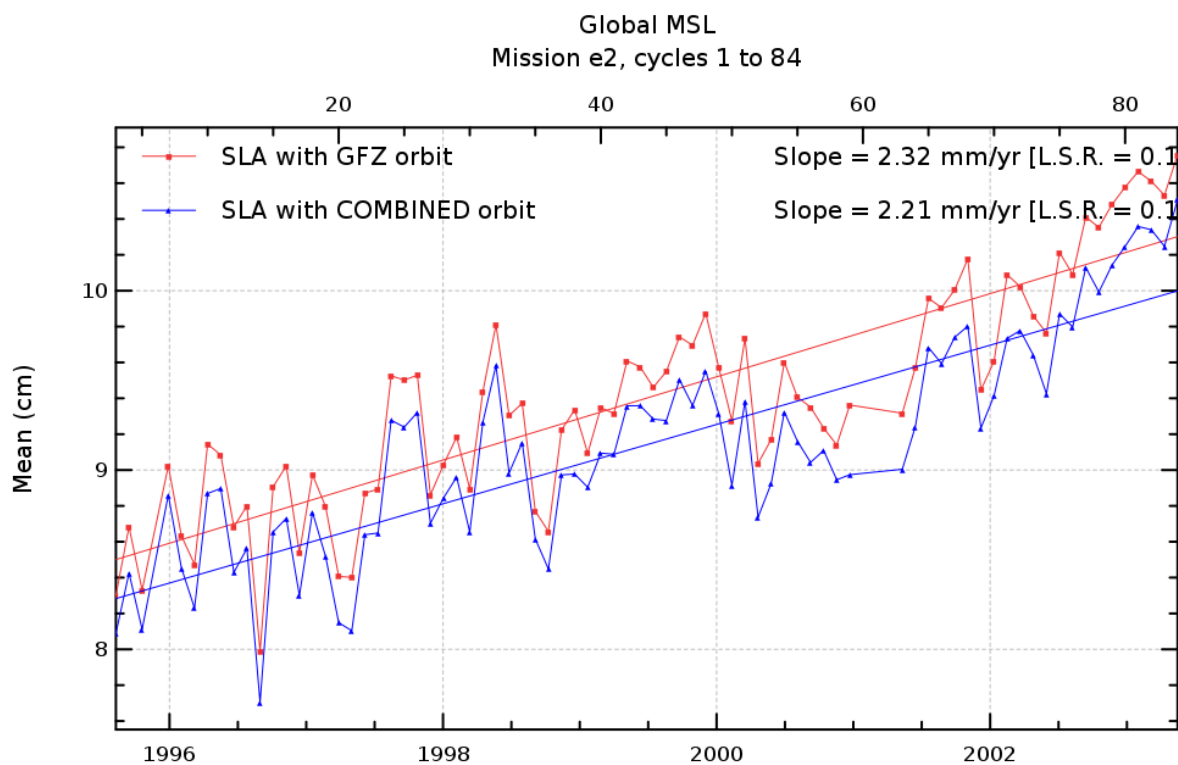
Diagnostic A201_a (mission e2)

Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses



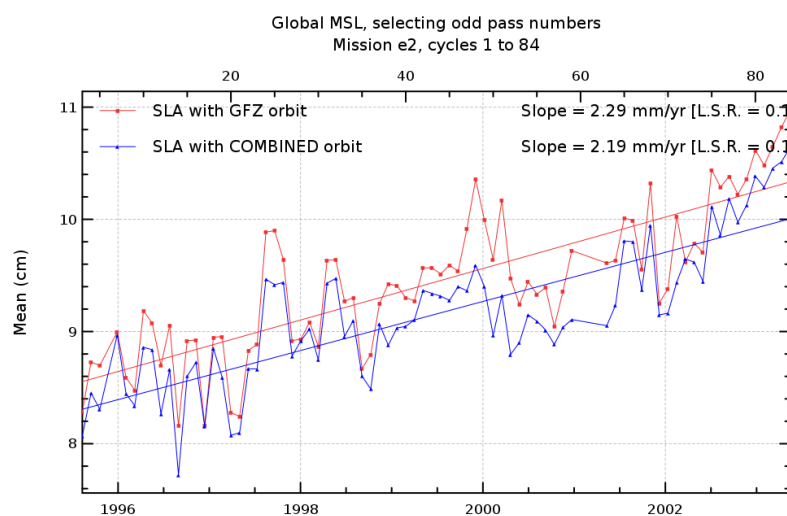
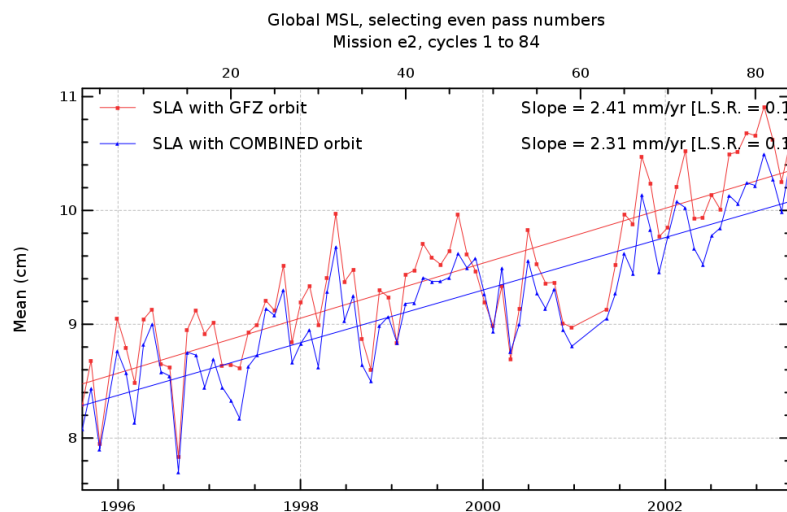
Diagnostic A201_b (mission e2)

Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses



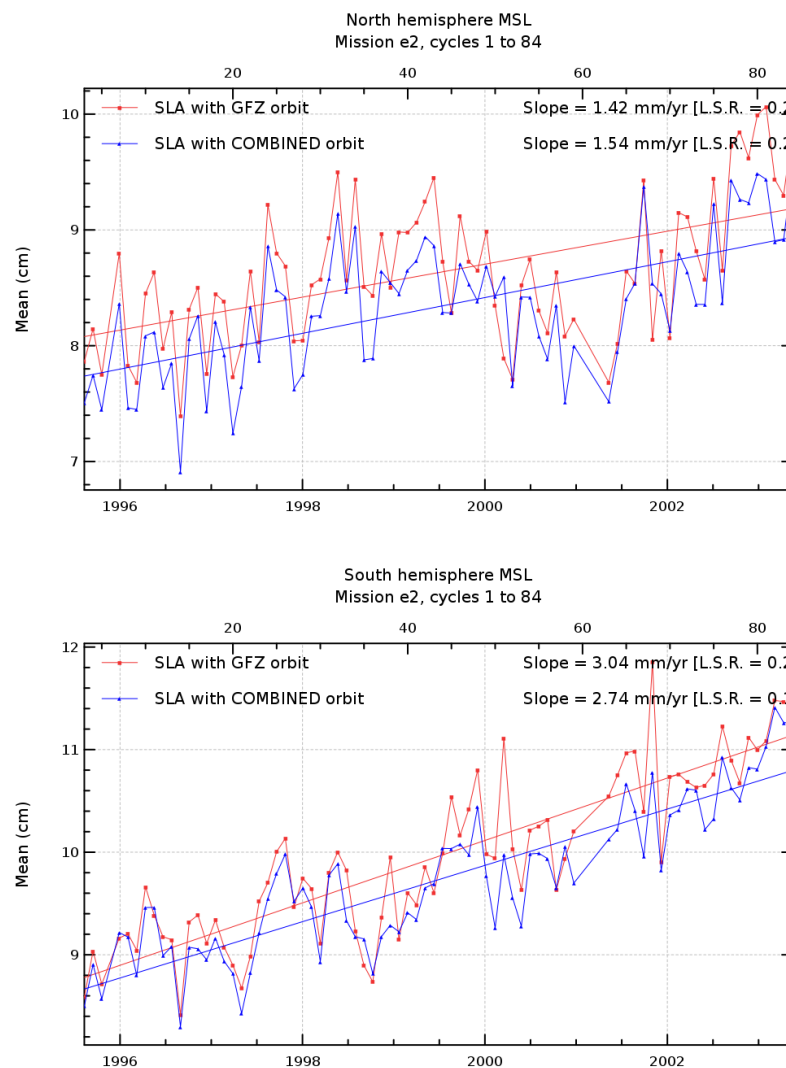
Diagnostic A201_c (mission e2)

Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses



Diagnostic A201_d (mission e2)

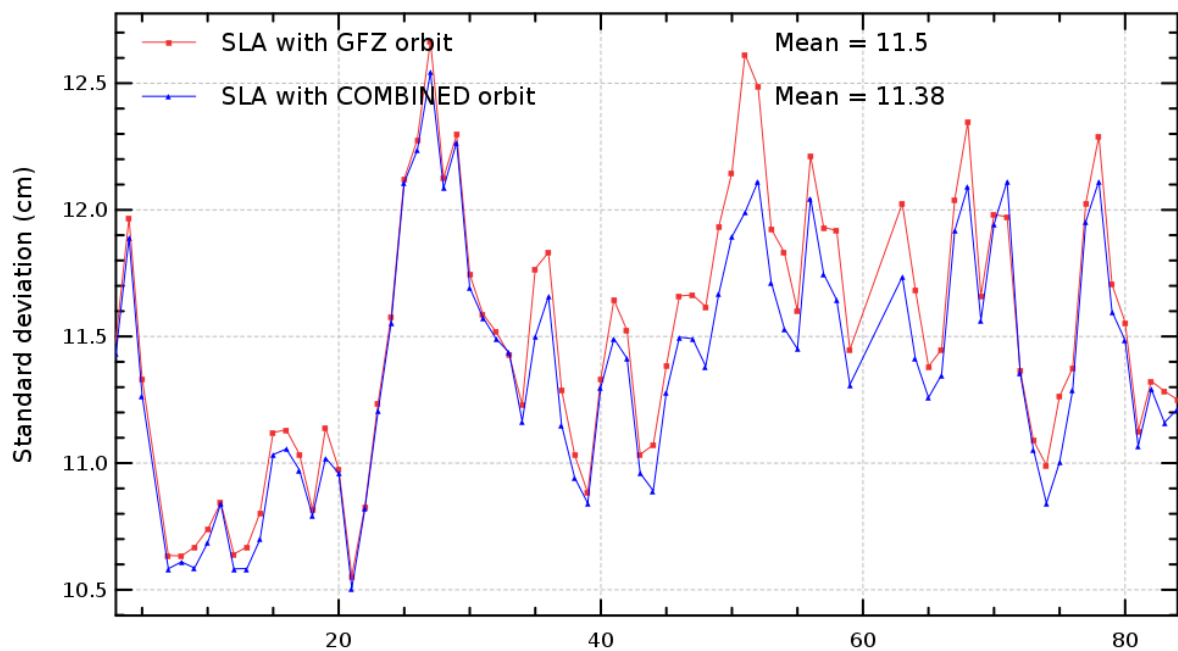
Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses

Global MSL
Mission e2, cycles 1 to 84



Diagnostic A201_e (mission e2)

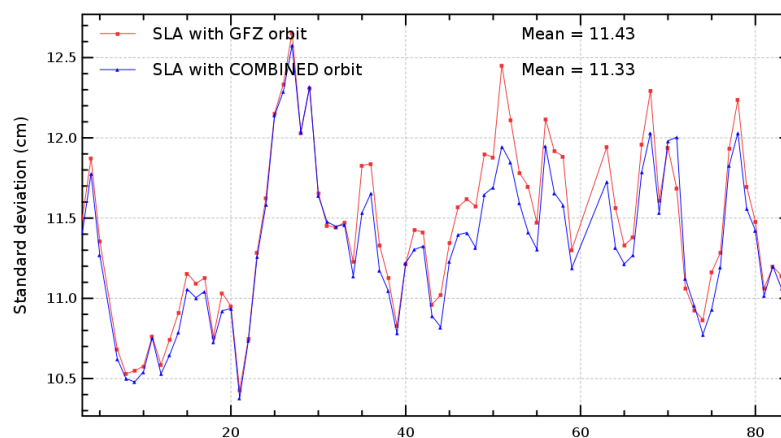
Name : Temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

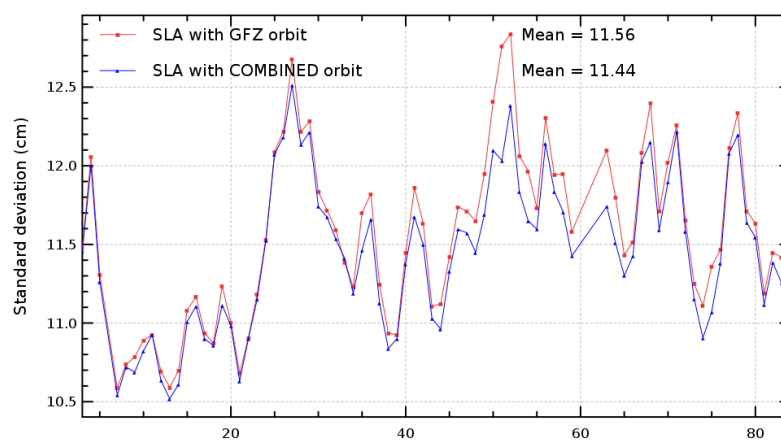
Description : The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) , or separating North and South hemispheres.

Diagnostic type : Global internal analyses

Global MSL, selecting even pass numbers
Mission e2, cycles 1 to 84



Global MSL, selecting odd pass numbers
Mission e2, cycles 1 to 84



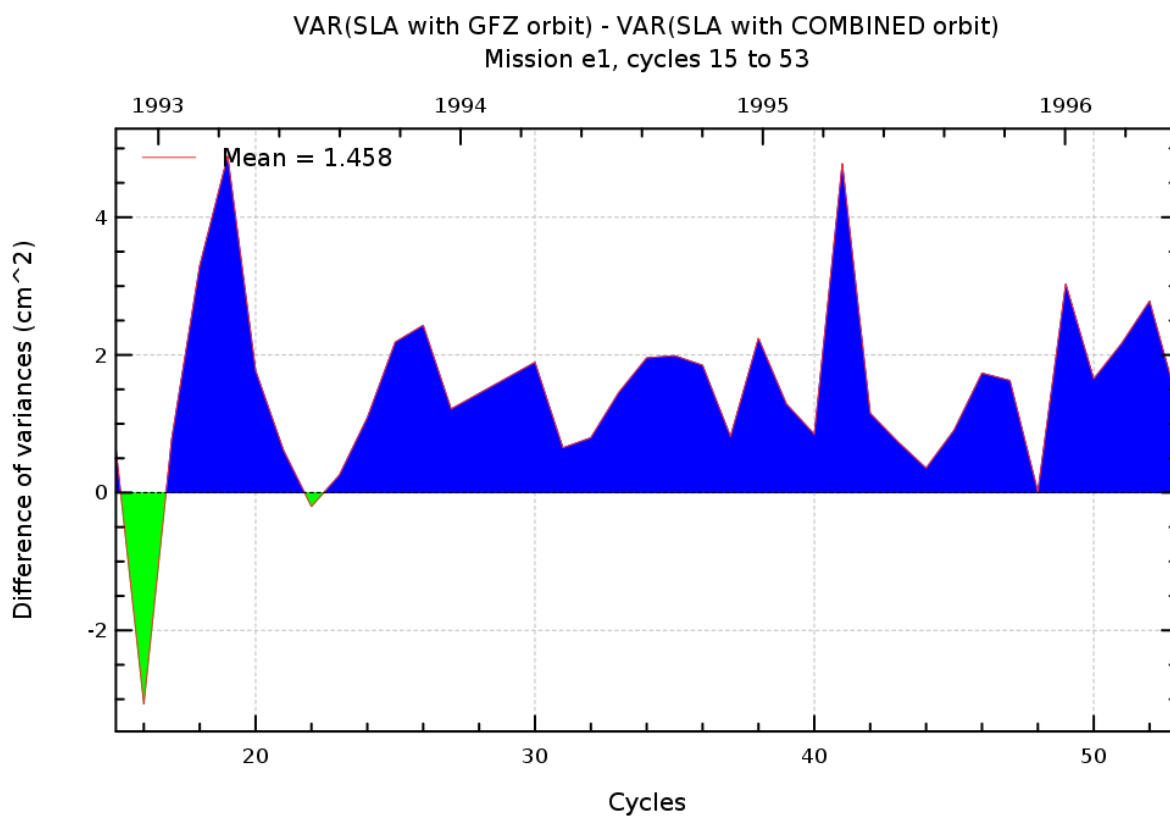
Diagnostic A202_a (mission e1)

Name : Differences between temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The differences between temporal evolution of SLA are calculated from statistics derived from diagnostic A201 (mean, variance) using 2 different components in the SLA calculation. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) or separating North and South hemispheres.

Diagnostic type : Global internal analyses



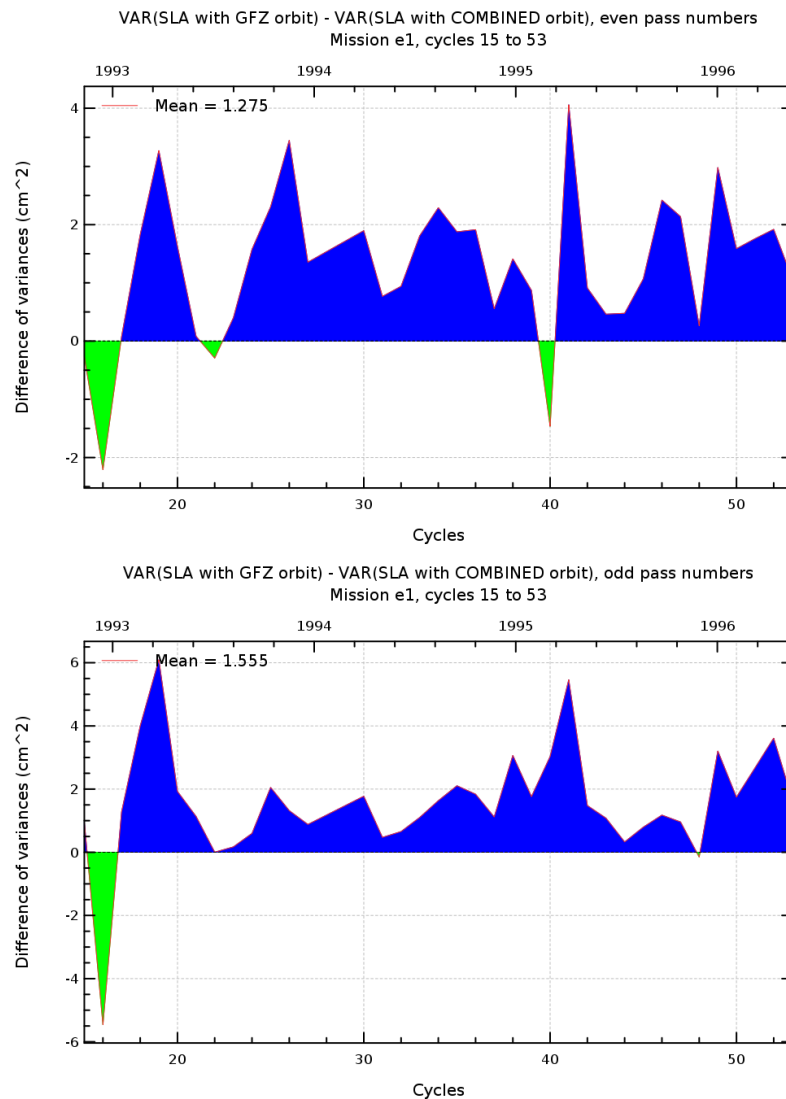
Diagnostic A202_b (mission e1)

Name : Differences between temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The differences between temporal evolution of SLA are calculated from statistics derived from diagnostic A201 (mean, variance) using 2 different components in the SLA calculation. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) or separating North and South hemispheres.

Diagnostic type : Global internal analyses



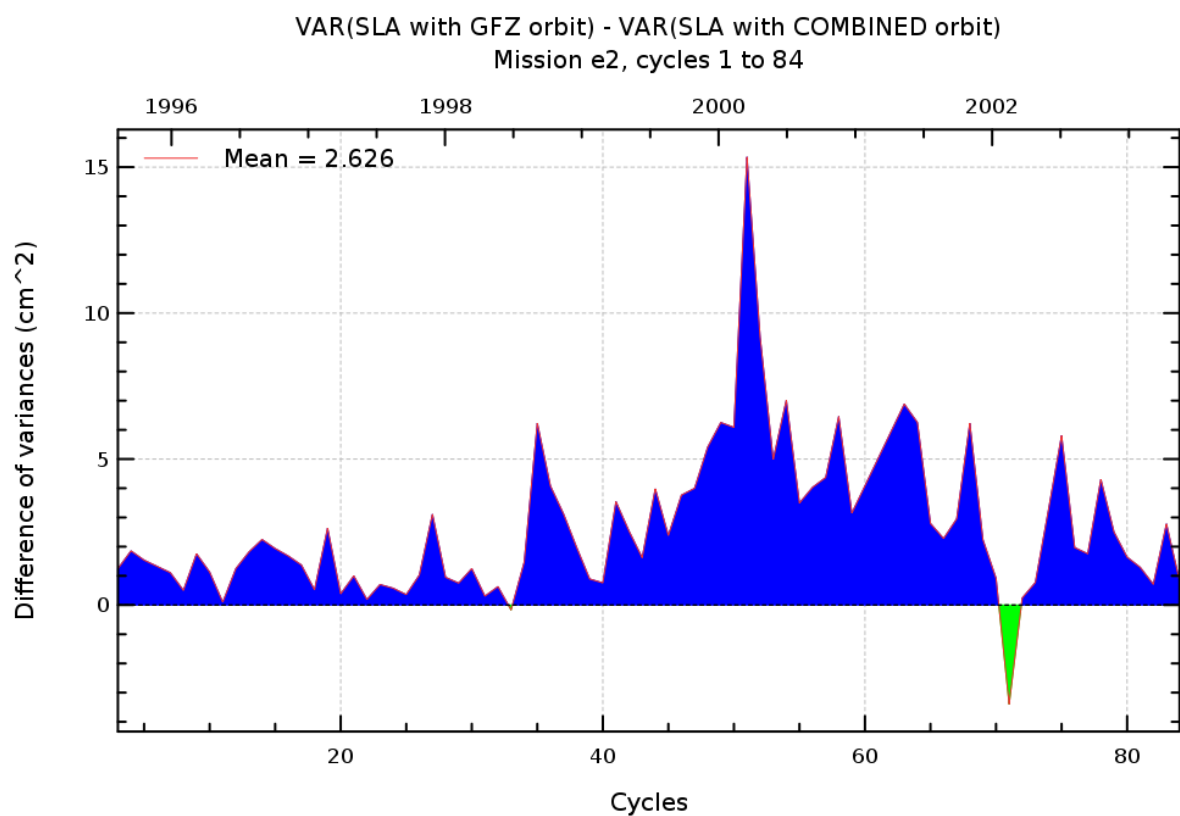
Diagnostic A202_a (mission e2)

Name : Differences between temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The differences between temporal evolution of SLA are calculated from statistics derived from diagnostic A201 (mean, variance) using 2 different components in the SLA calculation. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) or separating North and South hemispheres.

Diagnostic type : Global internal analyses



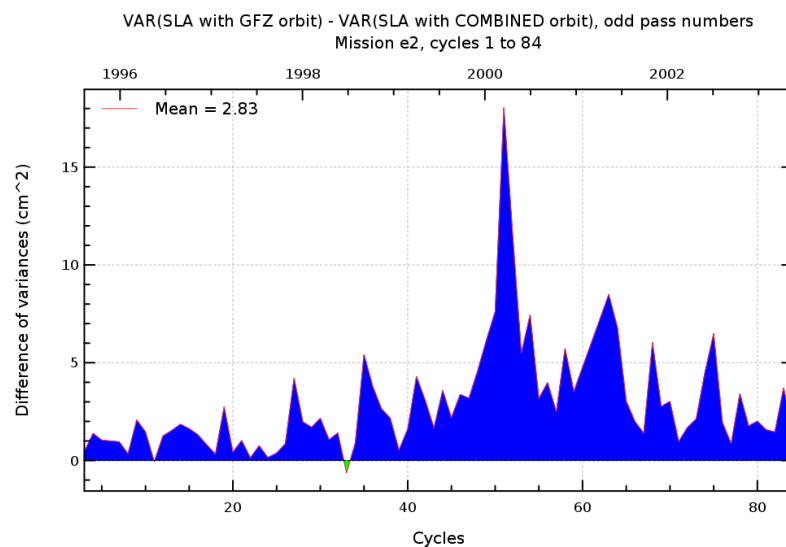
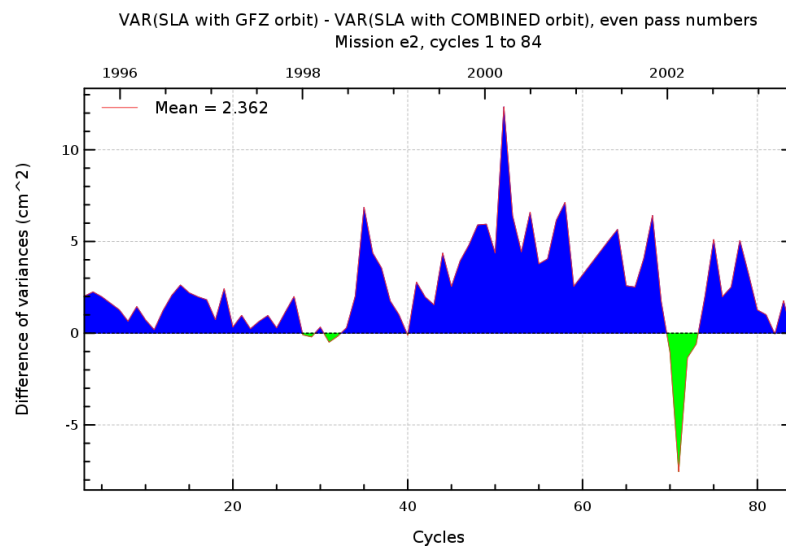
Diagnostic A202_b (mission e2)

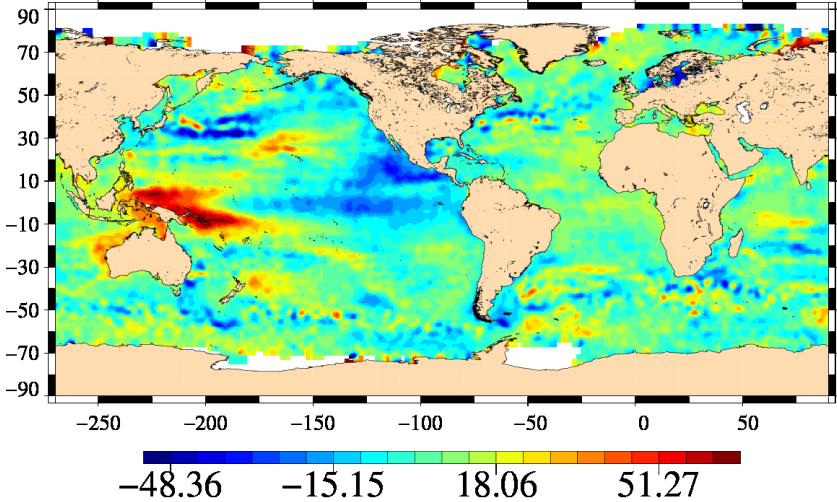
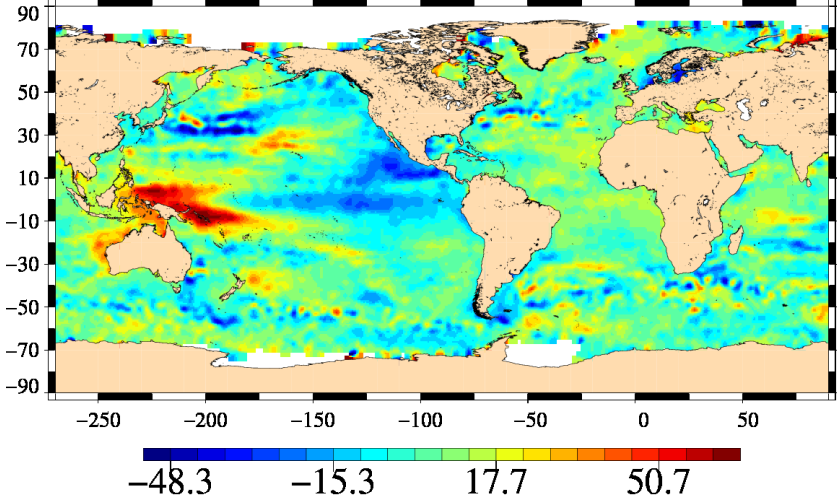
Name : Differences between temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The differences between temporal evolution of SLA are calculated from statistics derived from diagnostic A201 (mean, variance) using 2 different components in the SLA calculation. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) or separating North and South hemispheres.

Diagnostic type : Global internal analyses



Diagnostic type : Global internal analyses	Diagnostic A203_a (mission e1)	
	Name : Map of Sea Level Anomaly (SLA) over all the period	
	Input data : Along track SLA	
	Description : The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.	
	<div>SLA with GFZ orbit trends</div> <div>Mission e1, cycles 15 to 53</div>  <div>Trends (mm/yr)</div> <div>SLA with COMBINED orbit trends</div> <div>Mission e1, cycles 15 to 53</div>  <div>Trends (mm/yr)</div>	

Diagnostic A203_b (mission e1)

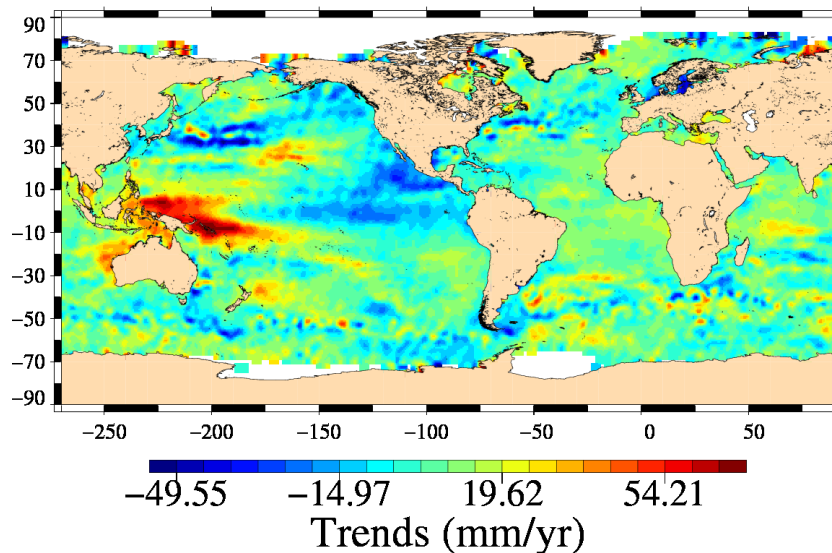
Name : Map of Sea Level Anomaly (SLA) over all the period

Input data : Along track SLA

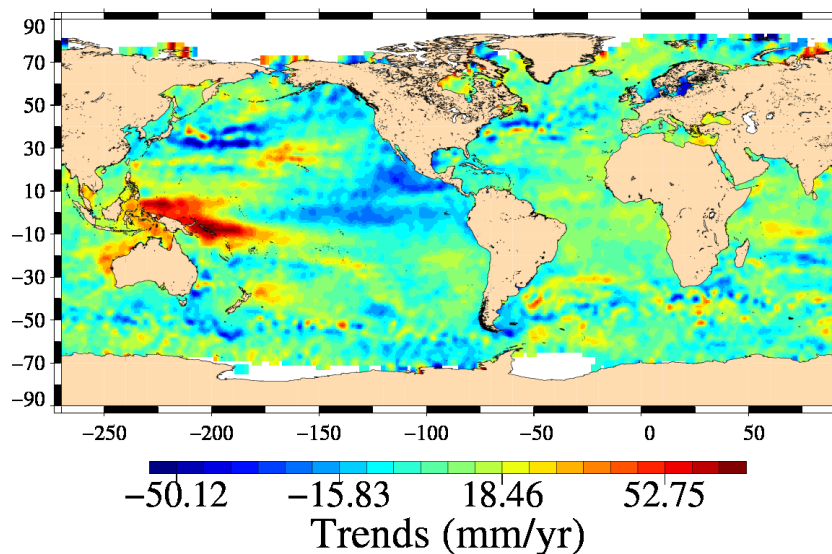
Description : The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with GFZ orbit trends : even pass numbers
Mission e1, cycles 15 to 53



SLA with COMBINED orbit trends : even pass numbers
Mission e1, cycles 15 to 53



Diagnostic A203_c (mission e1)

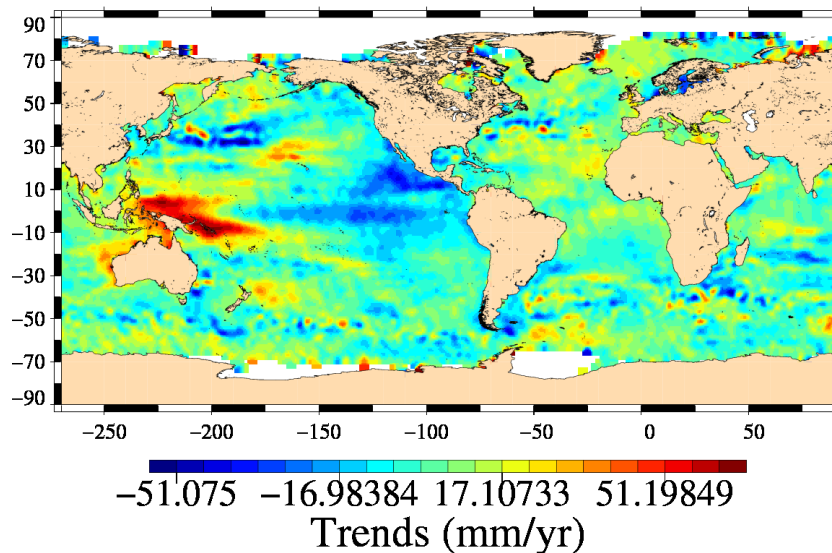
Name : Map of Sea Level Anomaly (SLA) over all the period

Input data : Along track SLA

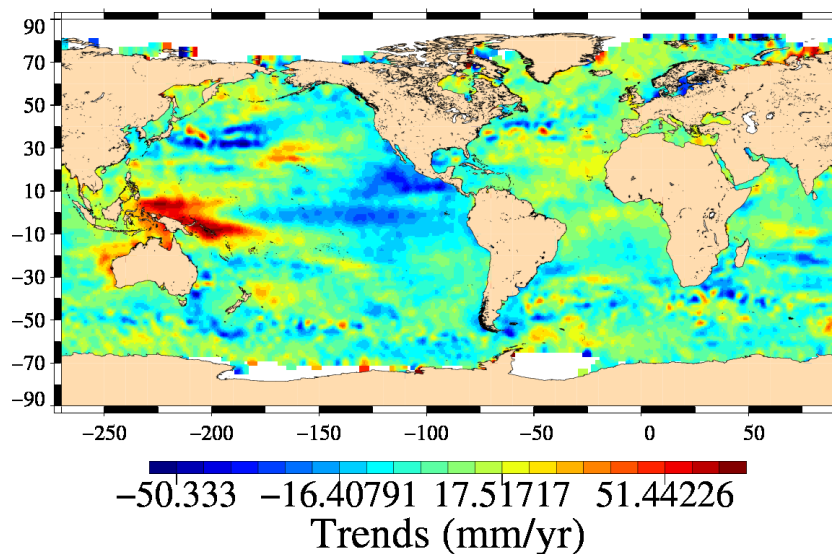
Description : The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with GFZ orbit trends : odd pass numbers
Mission e1, cycles 15 to 53



SLA with COMBINED orbit trends : odd pass numbers
Mission e1, cycles 15 to 53



Diagnostic A203_a (mission e2)

Name : Map of Sea Level Anomaly (SLA) over all the period

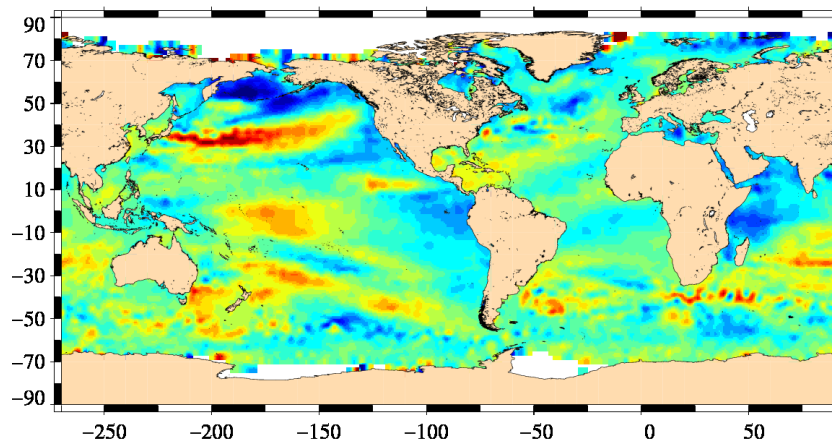
Input data : Along track SLA

Description : The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with GFZ orbit trends

Mission e2, cycles 1 to 84

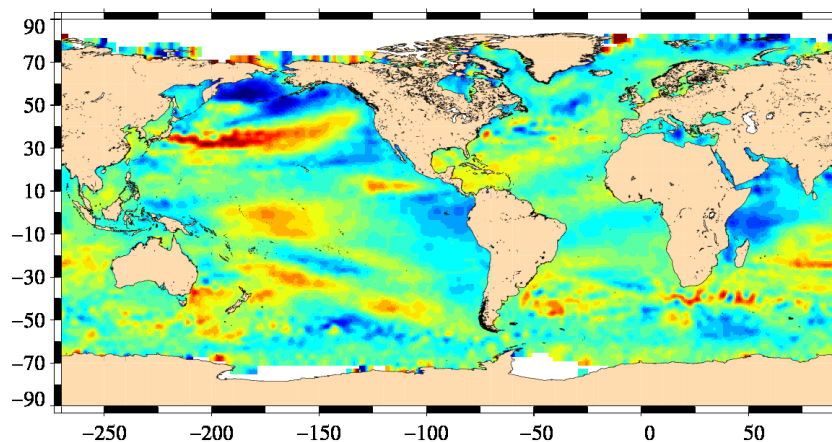


-20.06888 -6.77031 6.52825 19.82681

Trends (mm/yr)

SLA with COMBINED orbit trends

Mission e2, cycles 1 to 84



-19.86098 -6.73986 6.38126 19.50238

Trends (mm/yr)

Diagnostic A203_b (mission e2)

Name : Map of Sea Level Anomaly (SLA) over all the period

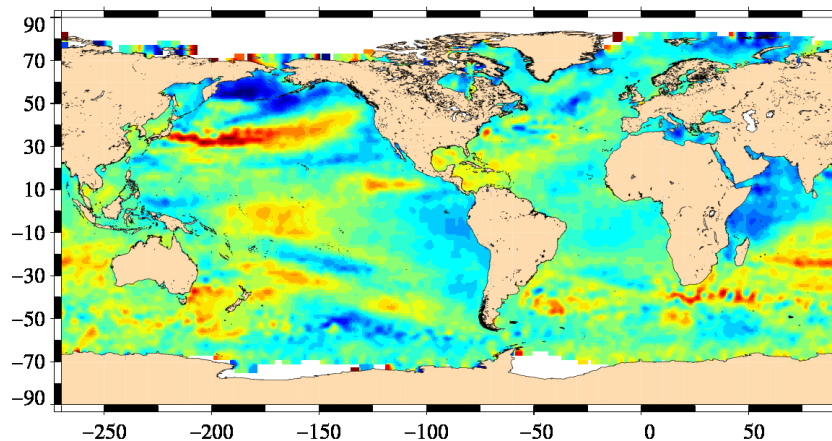
Input data : Along track SLA

Description : The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with GFZ orbit trends : even pass numbers

Mission e2, cycles 1 to 84

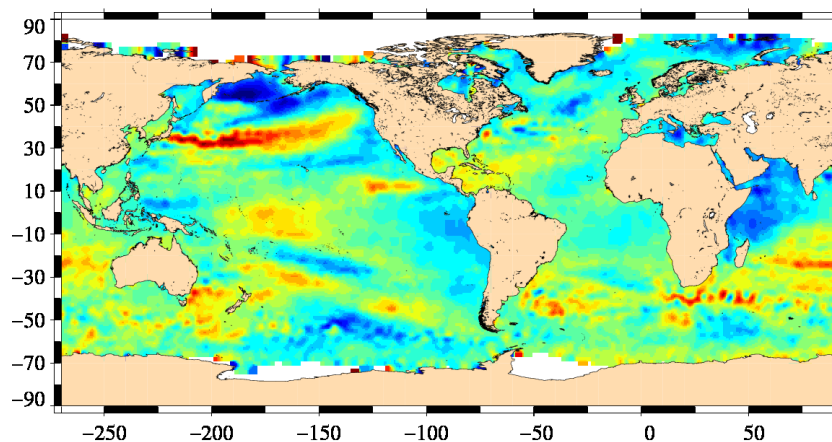


-21.47576 -7.31185 6.85206 21.01597

Trends (mm/yr)

SLA with COMBINED orbit trends : even pass numbers

Mission e2, cycles 1 to 84



-21.43452 -7.34873 6.73706 20.82286

Trends (mm/yr)

Diagnostic A203_c (mission e2)

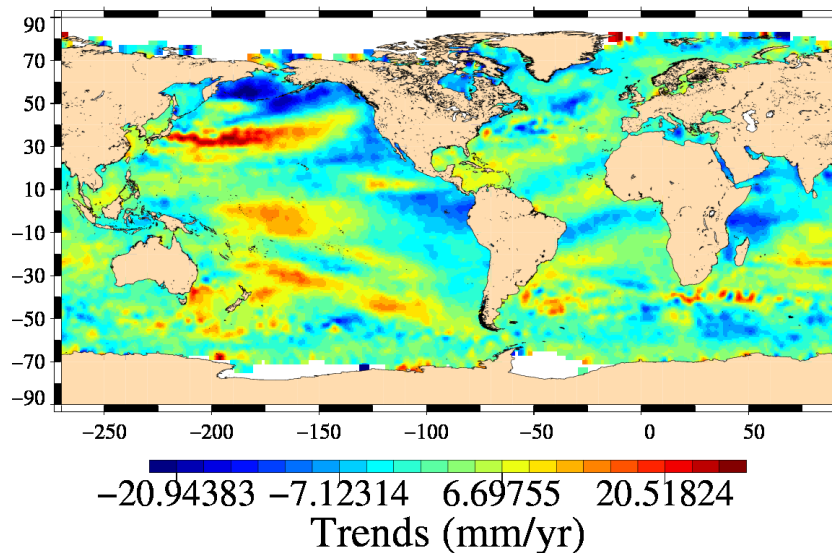
Name : Map of Sea Level Anomaly (SLA) over all the period

Input data : Along track SLA

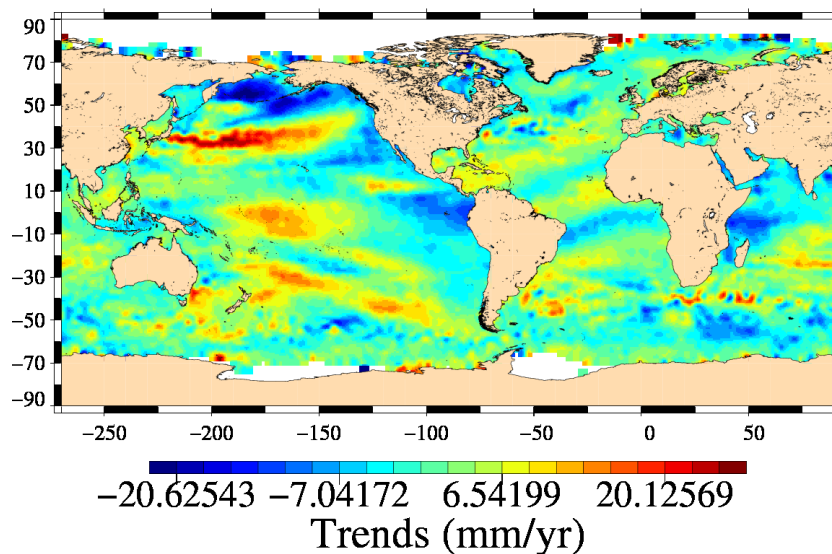
Description : The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

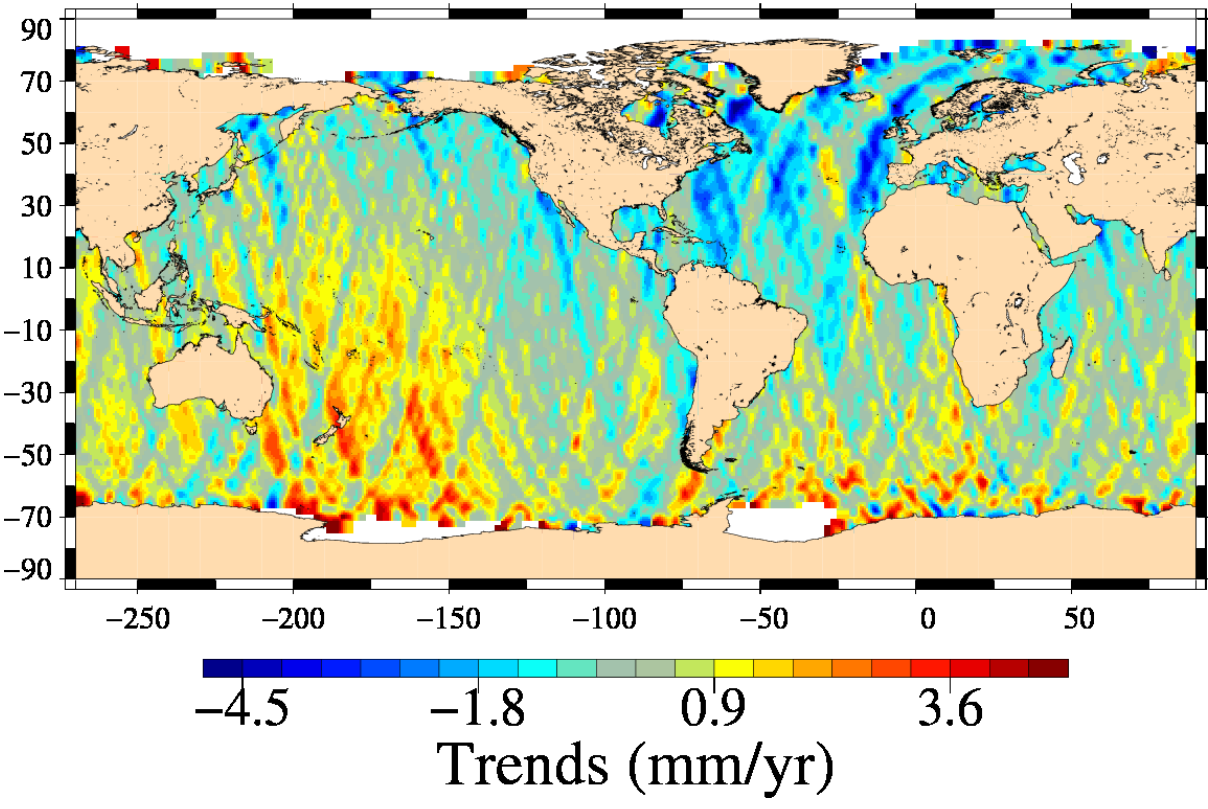
Diagnostic type : Global internal analyses

SLA with GFZ orbit trends : odd pass numbers
Mission e2, cycles 1 to 84



SLA with COMBINED orbit trends : odd pass numbers
Mission e2, cycles 1 to 84



Diagnostic type : Global internal analyses	Diagnostic A204_a (mission e1)	
	Name : Differences between maps of SLA	
	Input data : Along track SLA	
	Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).	
	<div>SLA with GFZ orbit trends – SLA with COMBINED orbit trends</div> <div>Mission e1, cycles 15 to 53</div> 	

Diagnostic A204_b (mission e1)

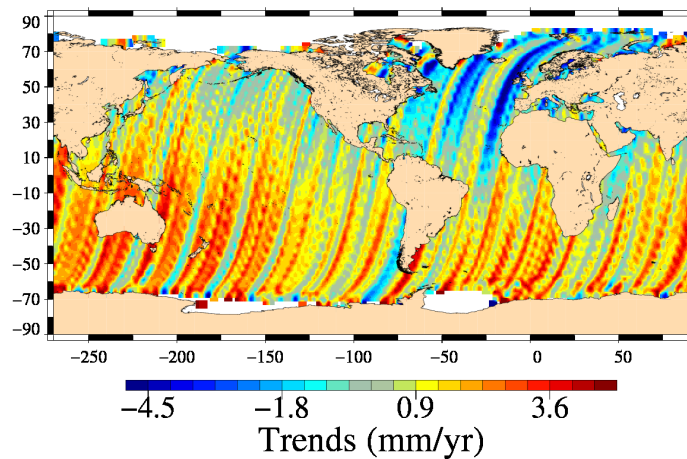
Name : Differences between maps of SLA

Input data : Along track SLA

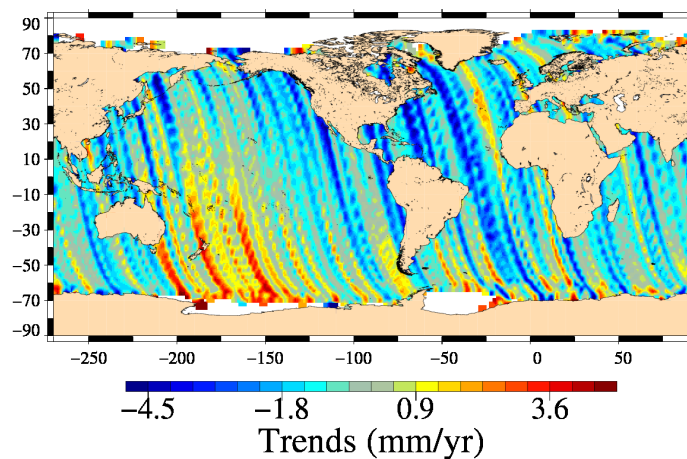
Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).

Diagnostic type : Global internal analyses

Δ with GFZ orbit trends – SLA with COMBINED orbit trends : even pass num
Mission e1, cycles 15 to 53



Δ with GFZ orbit trends – SLA with COMBINED orbit trends : odd pass num
Mission e1, cycles 15 to 53



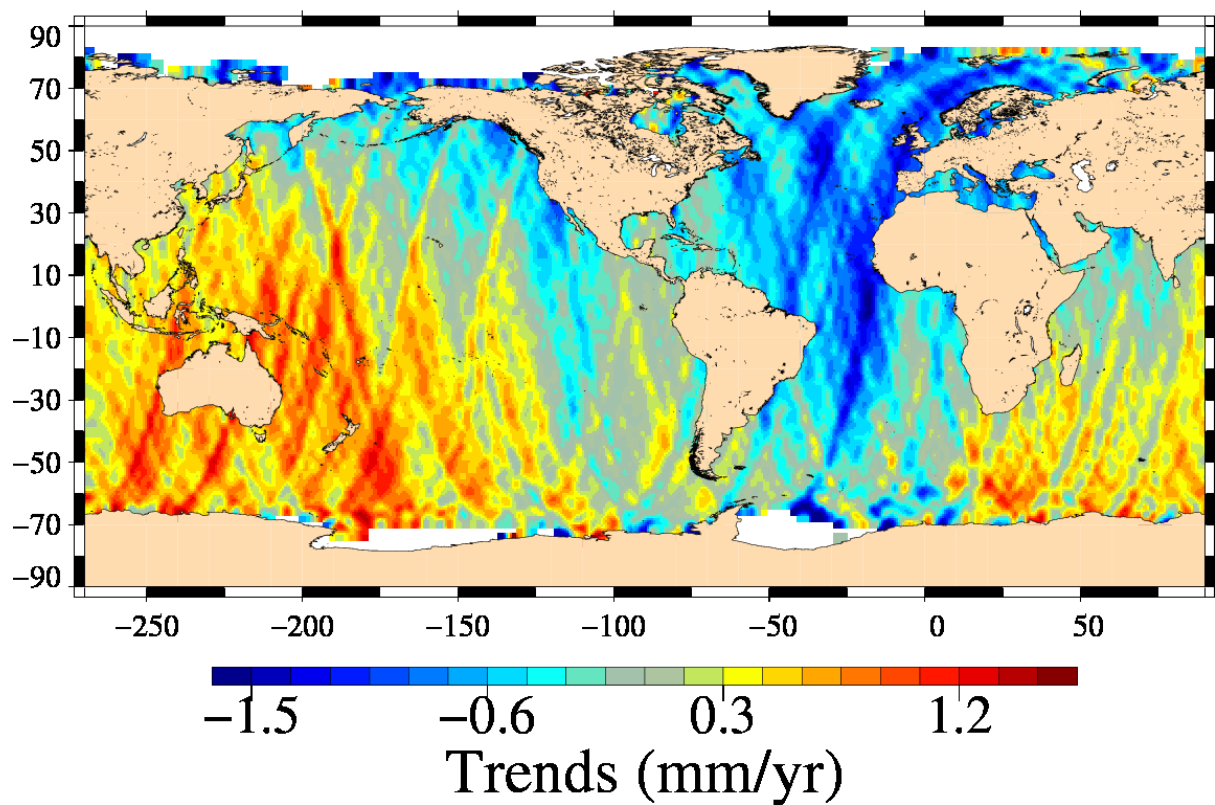
Diagnostic A204_a (mission e2)

Name : Differences between maps of SLA

Input data : Along track SLA

Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).

SLA with GFZ orbit trends – SLA with COMBINED orbit trends
Mission e2, cycles 1 to 84



Diagnostic A204_b (mission e2)

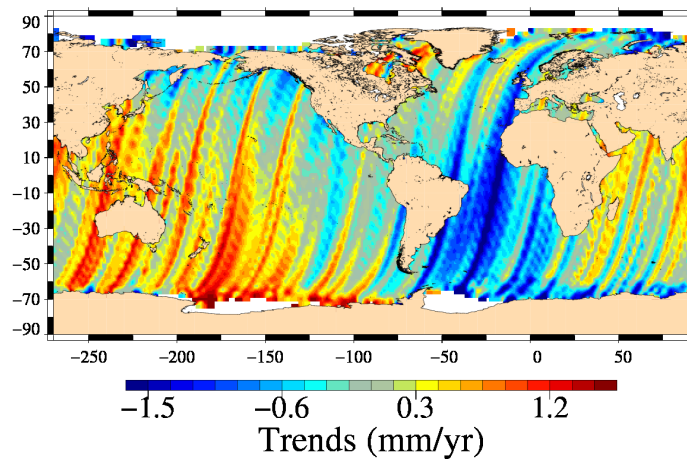
Name : Differences between maps of SLA

Input data : Along track SLA

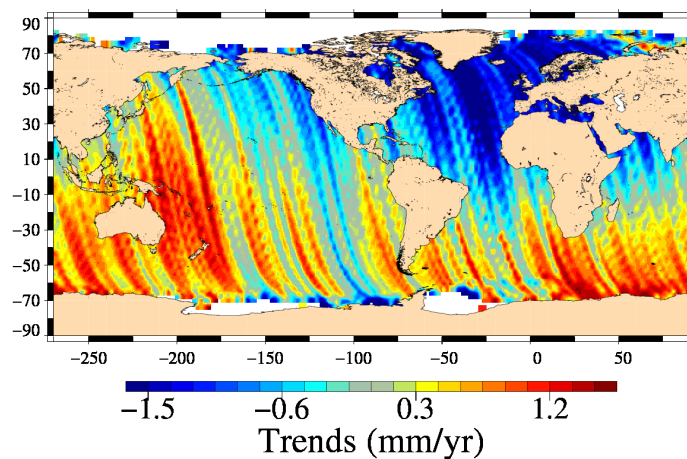
Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).

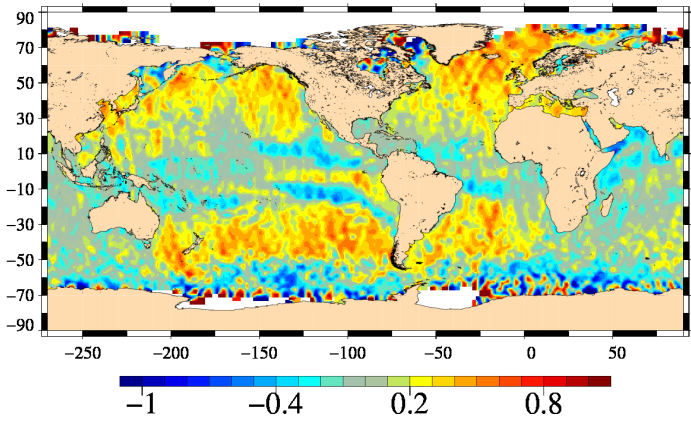
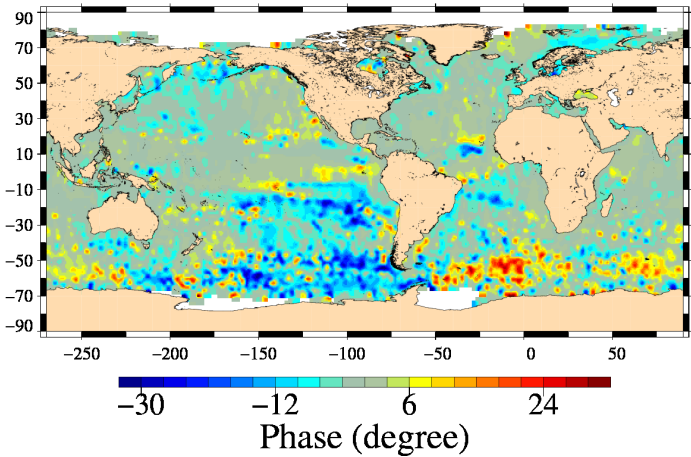
Diagnostic type : Global internal analyses

Δ with GFZ orbit trends – SLA with COMBINED orbit trends : even pass num
Mission e2, cycles 1 to 84



Δ with GFZ orbit trends – SLA with COMBINED orbit trends : odd pass num
Mission e2, cycles 1 to 84



Diagnostic type : Global internal analyses	Diagnostic A205_a (mission e1)	
	Name : Differences between maps of SLA (2)	
	Input data : Along track SLA	
	Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).	
	<div>with GFZ orbit amplitude – SLA with COMBINED orbit amplitude : annual s Mission e1, cycles 15 to 53</div> <div></div> <div>LA with GFZ orbit phase – SLA with COMBINED orbit phase : annual signa Mission e1, cycles 15 to 53</div> <div></div>	

Diagnostic A205_b (mission e1)

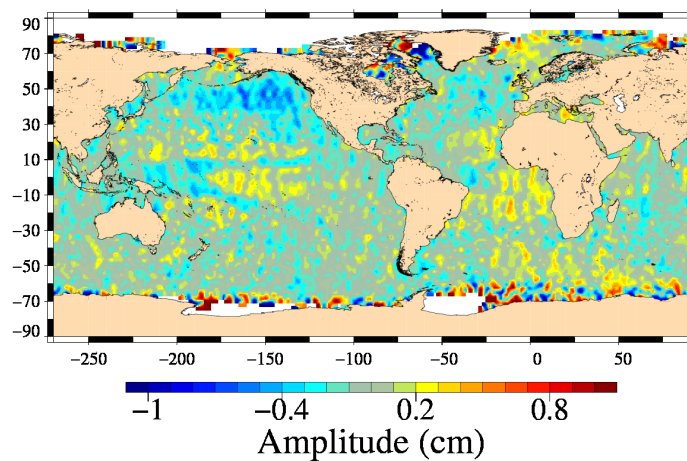
Name : Differences between maps of SLA (2)

Input data : Along track SLA

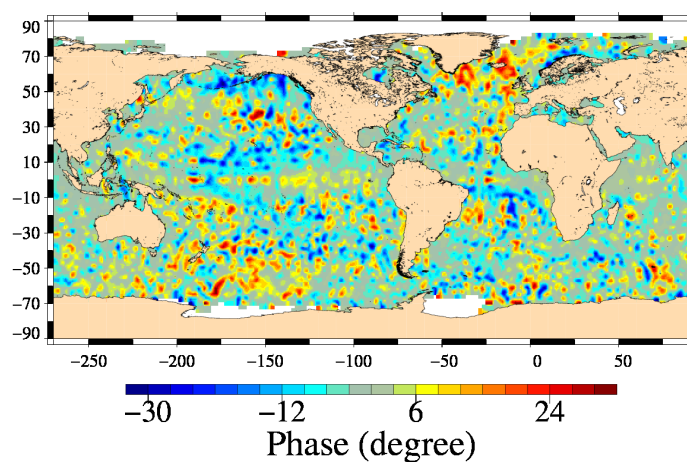
Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).

Diagnostic type : Global internal analyses

h GFZ orbit amplitude – SLA with COMBINED orbit amplitude : semi-annual
Mission e1, cycles 15 to 53



λ with GFZ orbit phase – SLA with COMBINED orbit phase : semi-annual si
Mission e1, cycles 15 to 53



Diagnostic A205_a (mission e2)

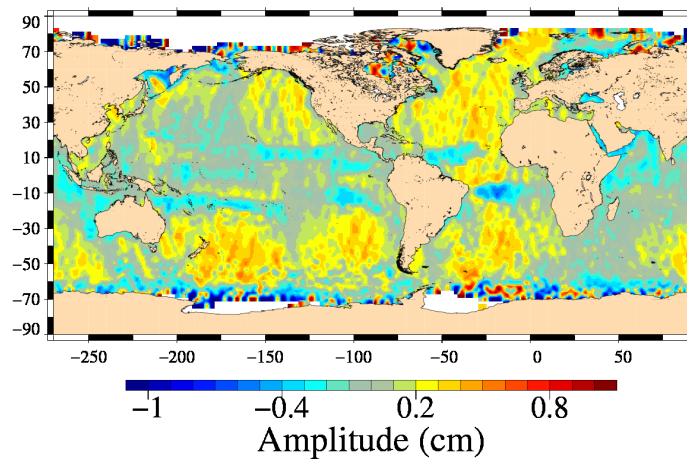
Name : Differences between maps of SLA (2)

Input data : Along track SLA

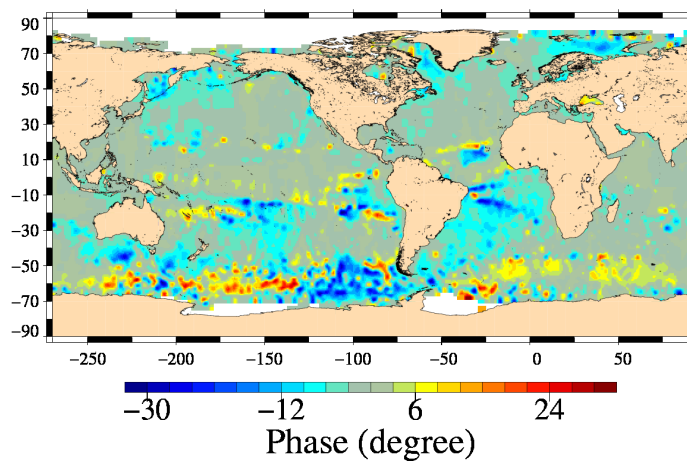
Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).

Diagnostic type : Global internal analyses

with GFZ orbit amplitude – SLA with COMBINED orbit amplitude : annual s
Mission e2, cycles 1 to 84



LA with GFZ orbit phase – SLA with COMBINED orbit phase : annual signa
Mission e2, cycles 1 to 84



Diagnostic A205_b (mission e2)

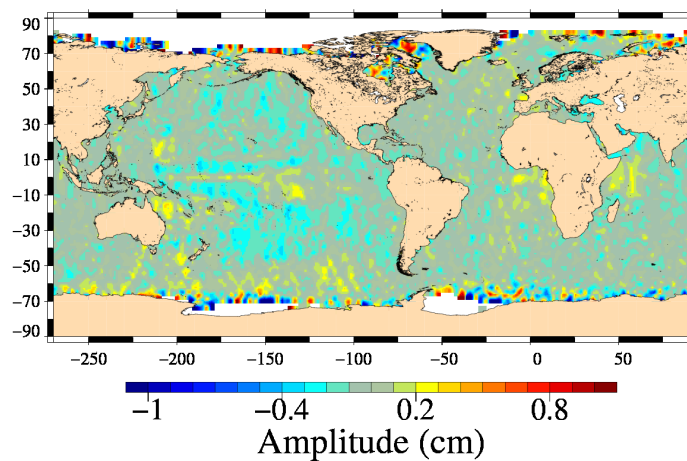
Name : Differences between maps of SLA (2)

Input data : Along track SLA

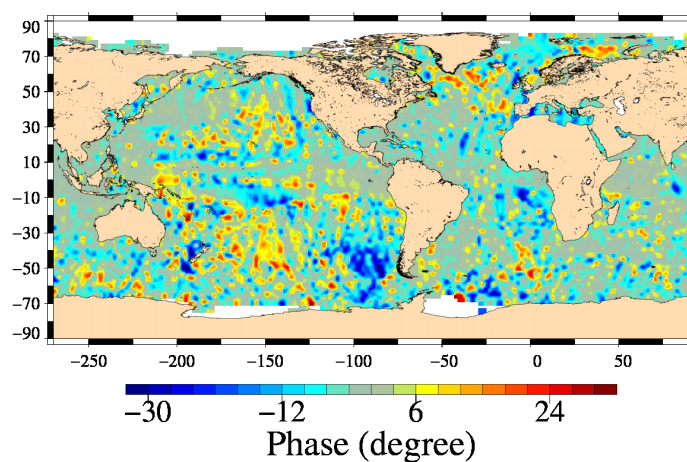
Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).

Diagnostic type : Global internal analyses

h GFZ orbit amplitude – SLA with COMBINED orbit amplitude : semi-annual
Mission e2, cycles 1 to 84



h with GFZ orbit phase – SLA with COMBINED orbit phase : semi-annual si
Mission e2, cycles 1 to 84

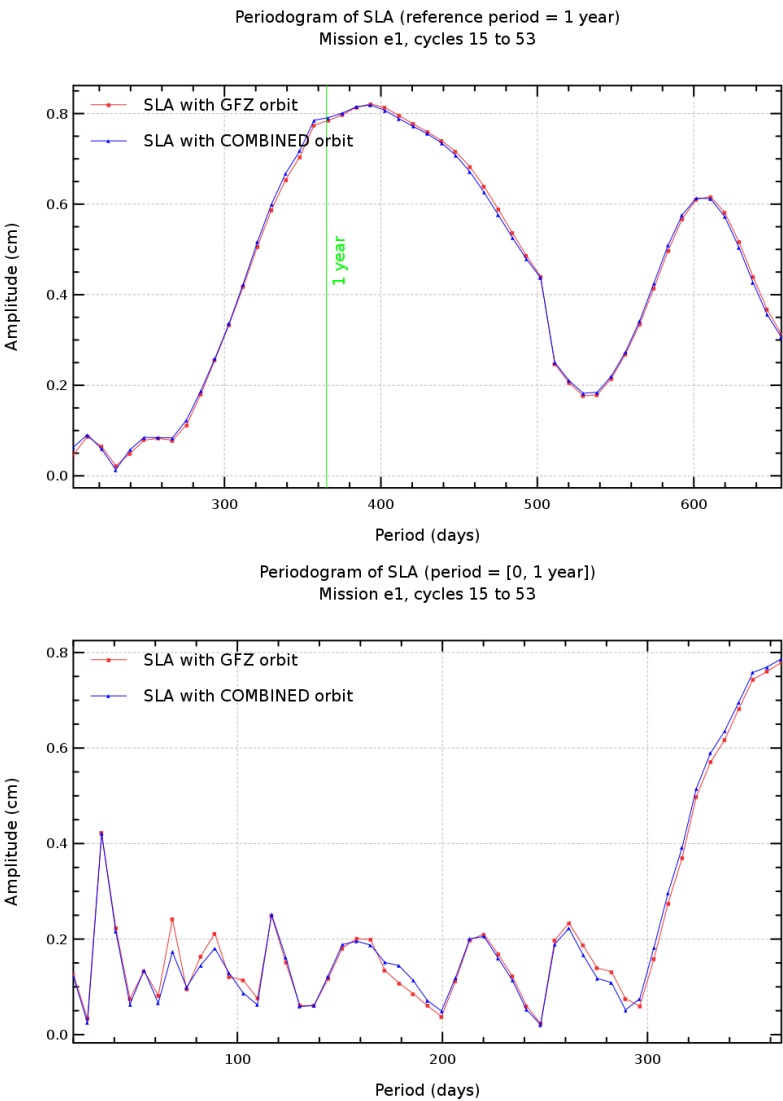


Diagnostic A206_a (mission e1)

Name : Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.



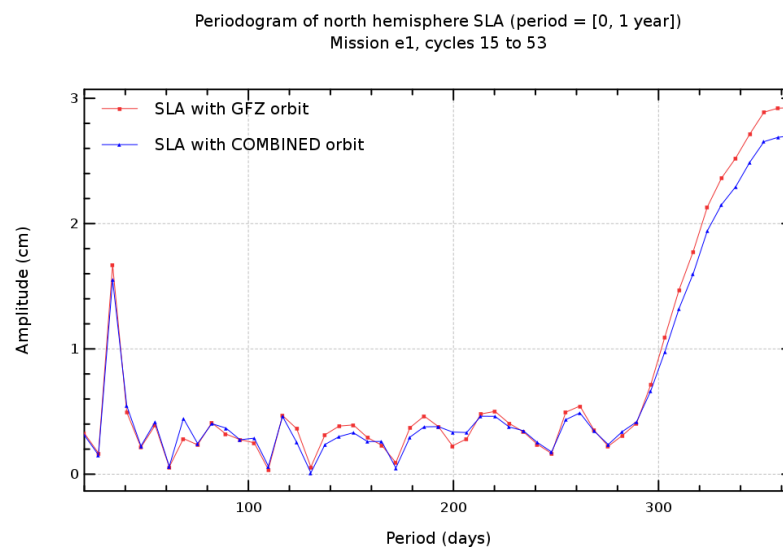
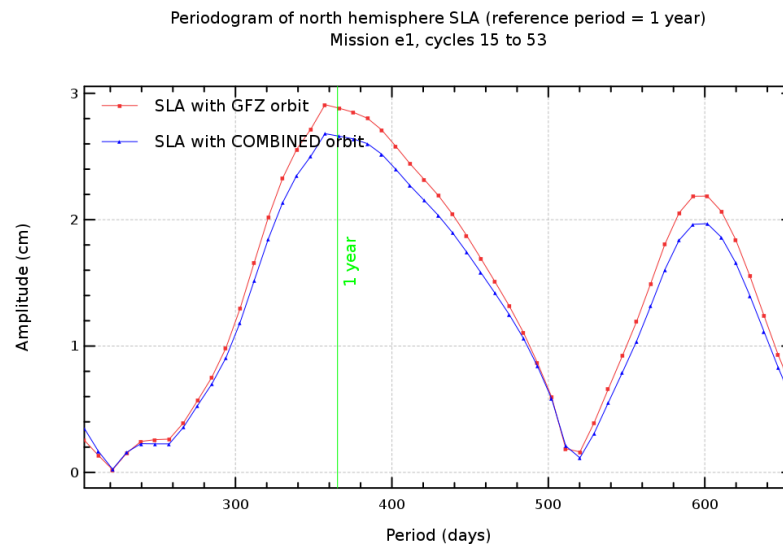
Diagnostic A206_b (mission e1)

Name : Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.

Diagnostic type : Global internal analyses



Diagnostic A206_c (mission e1)

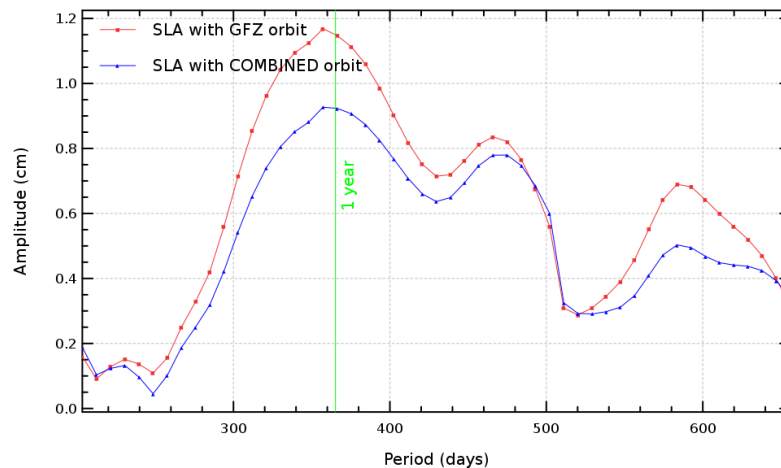
Name : Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

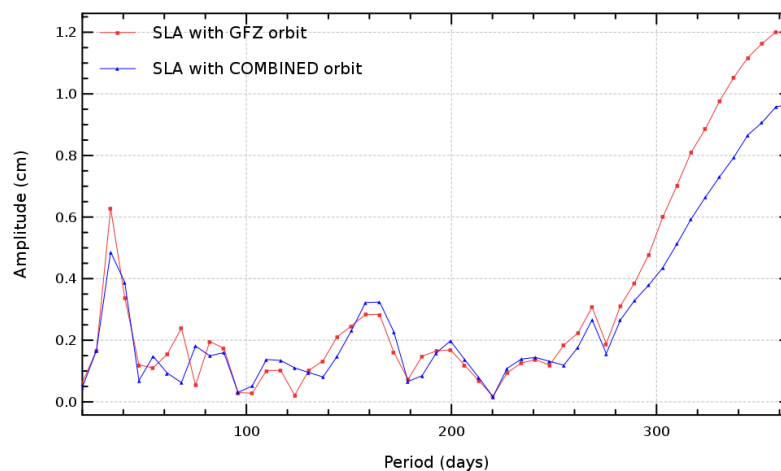
Description : The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.

Diagnostic type : Global internal analyses

Periodogram of south hemisphere SLA (reference period = 1 year)
Mission e1, cycles 15 to 53



Periodogram of south hemisphere SLA (period = [0, 1 year])
Mission e1, cycles 15 to 53



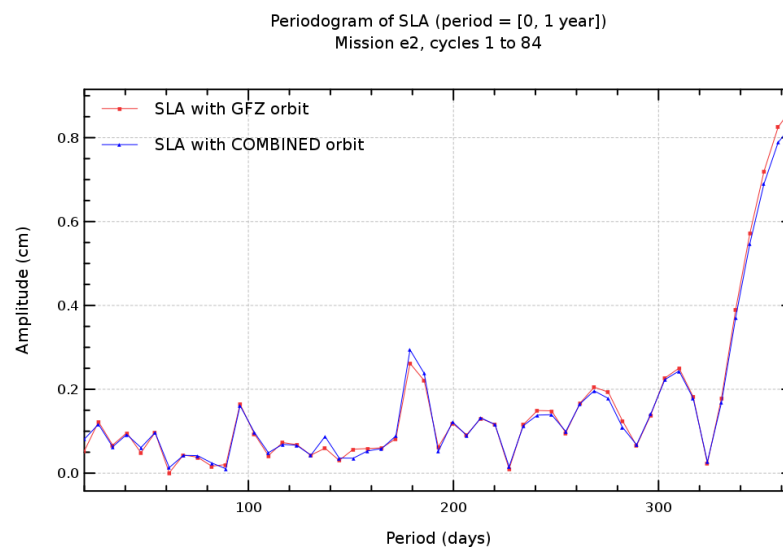
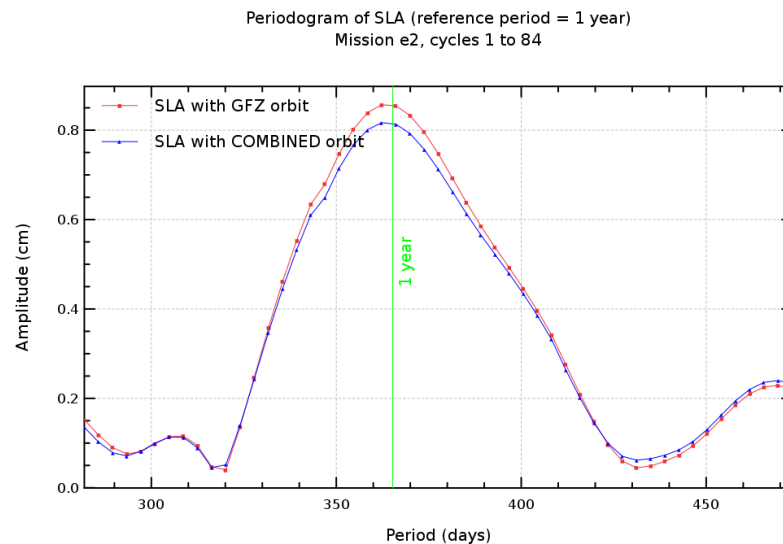
Diagnostic A206_a (mission e2)

Name : Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

Description : The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.

Diagnostic type : Global internal analyses



Diagnostic A206_b (mission e2)

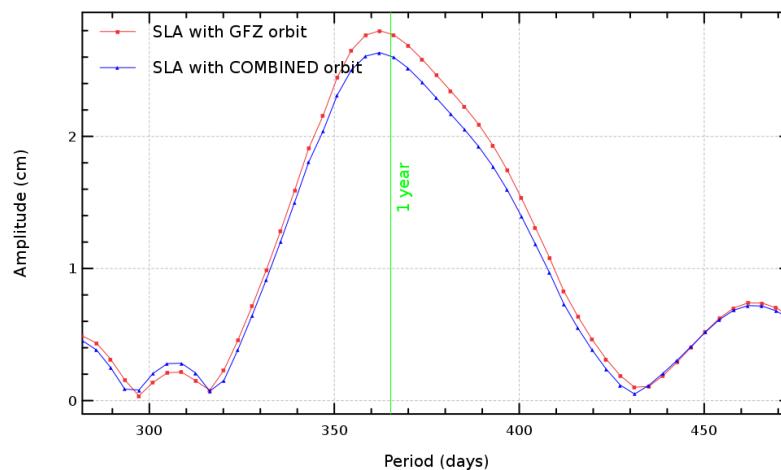
Name : Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

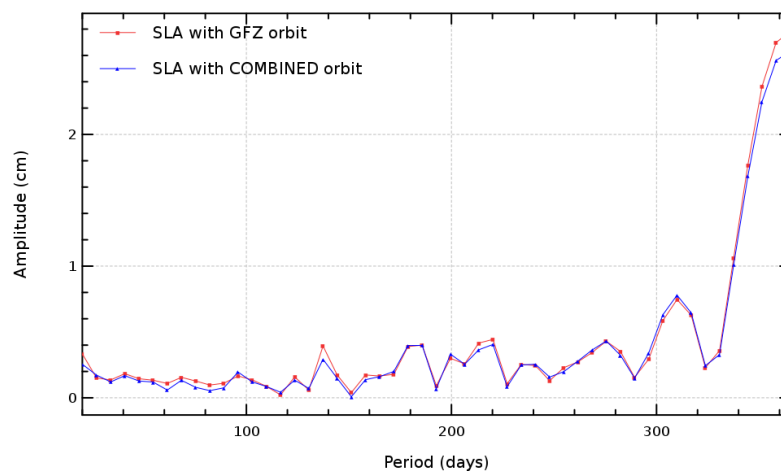
Description : The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.

Diagnostic type : Global internal analyses

Periodogram of north hemisphere SLA (reference period = 1 year)
Mission e2, cycles 1 to 84



Periodogram of north hemisphere SLA (period = [0, 1 year])
Mission e2, cycles 1 to 84



Diagnostic A206_c (mission e2)

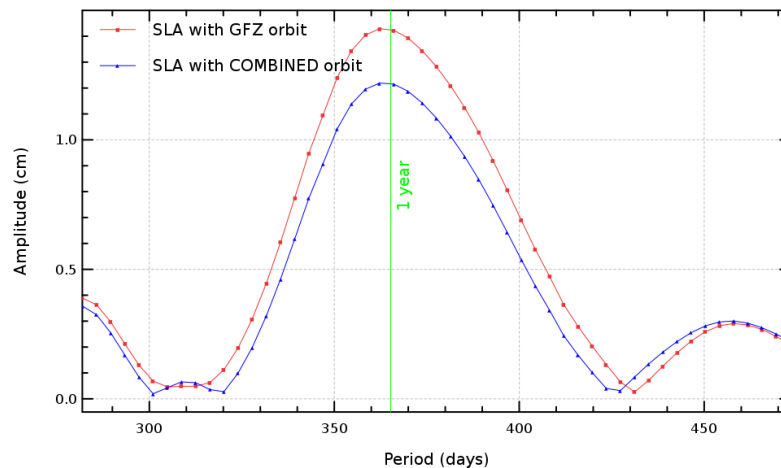
Name : Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

Input data : Along track SLA

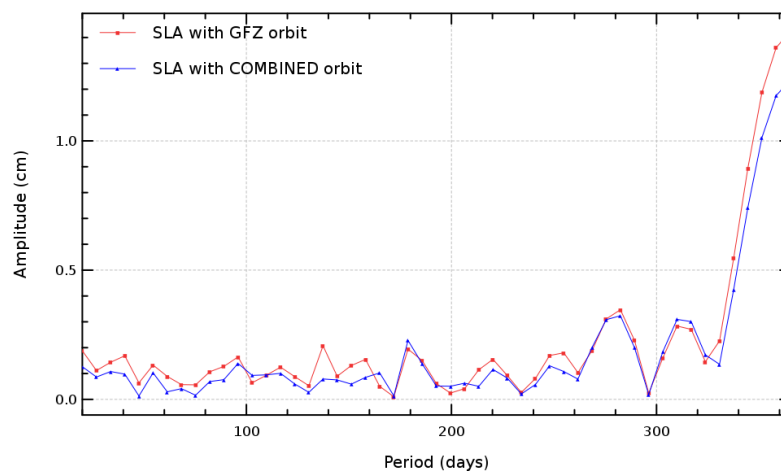
Description : The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.

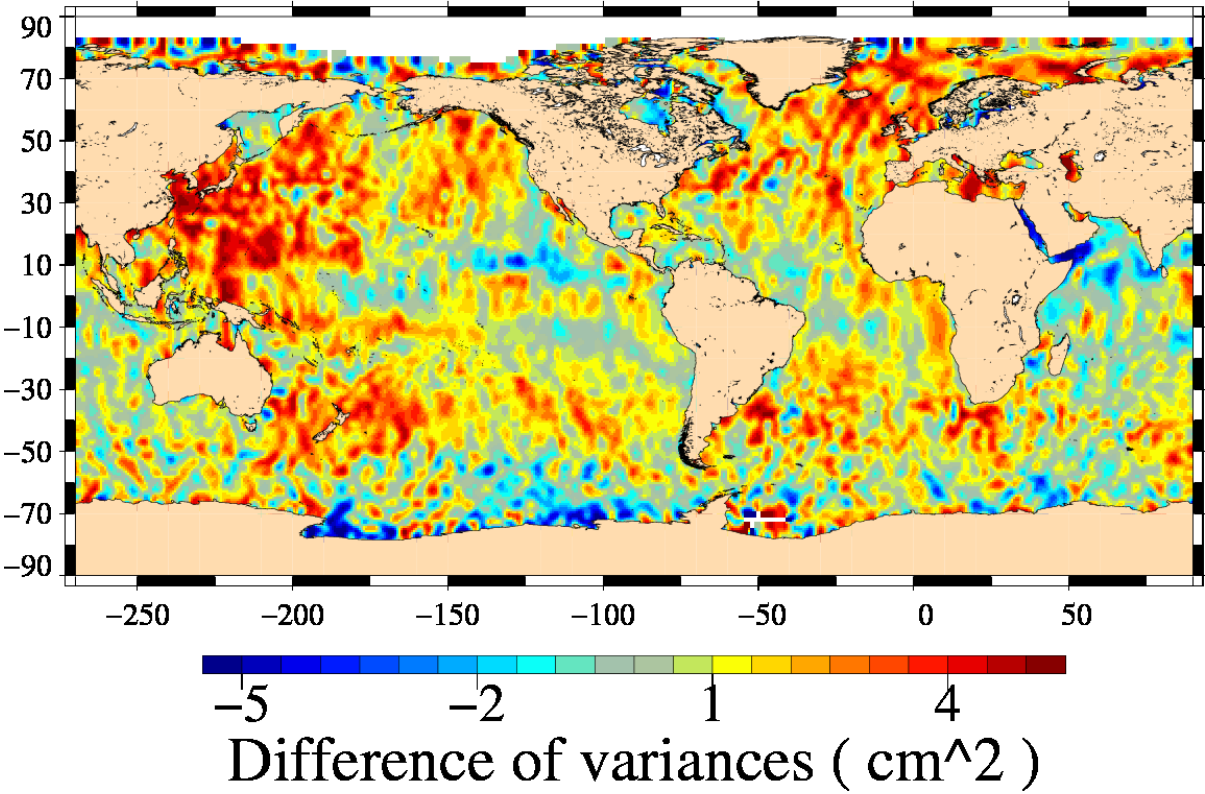
Diagnostic type : Global internal analyses

Periodogram of south hemisphere SLA (reference period = 1 year)
Mission e2, cycles 1 to 84



Periodogram of south hemisphere SLA (period = [0, 1 year])
Mission e2, cycles 1 to 84



Diagnostic type : Global internal analyses	Diagnostic A209 (mission e1)	
	Name : Differences between maps of SLA (3)	
	Input data : Along track SLA	
	Description : The differences between maps of SLA are calculated from the SLA differences (mean, standard deviation) using successively both altimetric components in the SLA calculation.	
	<div>VAR(SLA with GFZ orbit) – VAR(SLA with COMBINED orbit)</div> <div>Mission e1, cycles 15 to 53</div> 	

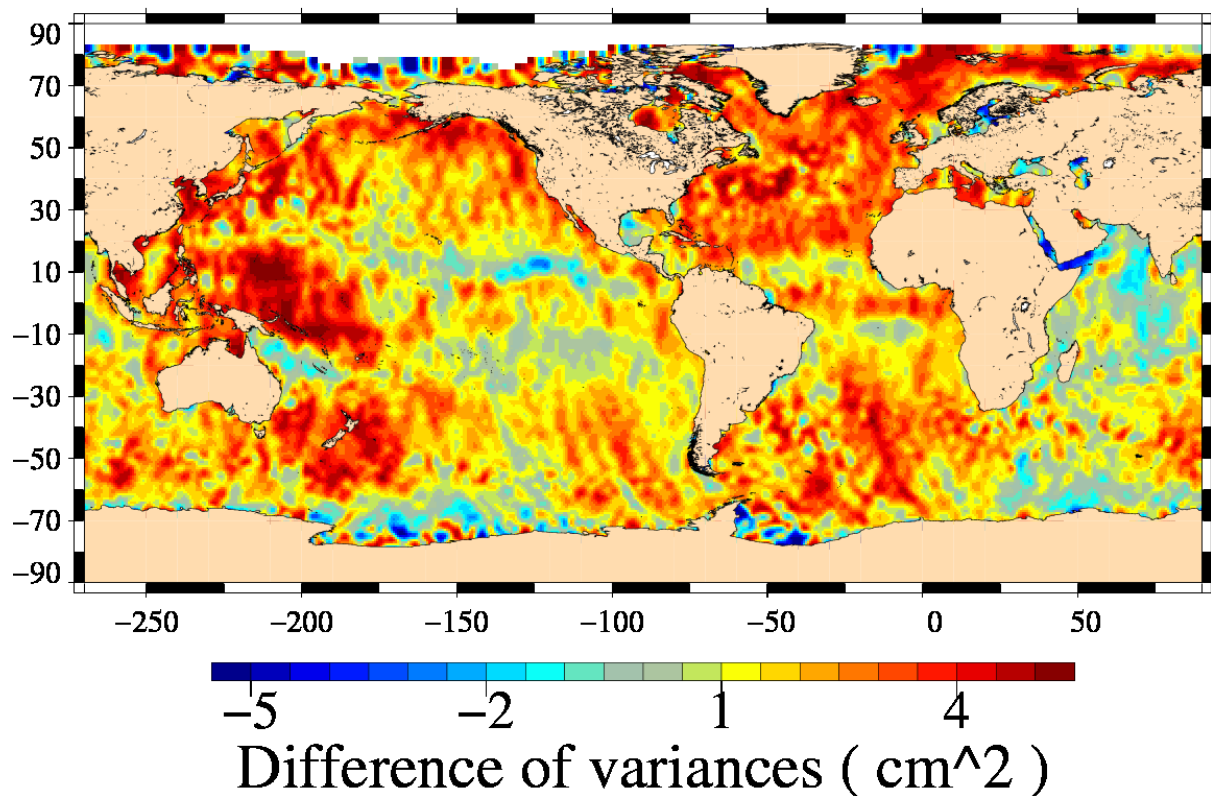
Diagnostic A209 (mission e2)

Name : Differences between maps of SLA (3)

Input data : Along track SLA

Description : The differences between maps of SLA are calculated from the SLA differences (mean, standard deviation) using successively both altimetric components in the SLA calculation.

VAR(SLA with GFZ orbit) – VAR(SLA with COMBINED orbit)
Mission e2, cycles 1 to 84



Diagnostic type : Altimetry and in-situ data comparison	Diagnostic C001 (mission e1)																														
	Name : Temporal evolution of SSH differences between tide gauges and altimetry measurements																														
	Input data : Tide gauges SSH measurements																														
	Description : The temporal evolution of global statistics (mean, variance, slope) of SSH differences between tide gauges and altimeter measurements are calculated from a cyclic way (altimeter repetivity) using successively both altimetric components in SSH calculation. The altimetric and tide gauges data are colocated with criteria of maximum of correlation, and tide gauges used are derived from global networks (GLOSS/CLIVAR, REFMAR).																														
	<div>SLA differences : altimetry measurements - tide gauges Mission e1, cycles 15 to 53</div> <table border="1"><caption>Approximate data points from the SLA differences graph</caption><thead><tr><th>Year</th><th>SLA with GFZ orbit - T. G. (cm)</th><th>SLA with COMBINED orbit - T. G. (cm)</th></tr></thead><tbody><tr><td>1993-01</td><td>-2.0</td><td>-1.8</td></tr><tr><td>1993-06</td><td>-1.5</td><td>-1.2</td></tr><tr><td>1993-12</td><td>-0.5</td><td>-0.2</td></tr><tr><td>1994-06</td><td>0.5</td><td>0.2</td></tr><tr><td>1994-12</td><td>1.0</td><td>0.8</td></tr><tr><td>1995-06</td><td>0.5</td><td>0.5</td></tr><tr><td>1995-12</td><td>0.2</td><td>0.1</td></tr><tr><td>1996-06</td><td>0.5</td><td>0.4</td></tr><tr><td>1996-12</td><td>0.8</td><td>0.6</td></tr></tbody></table>		Year	SLA with GFZ orbit - T. G. (cm)	SLA with COMBINED orbit - T. G. (cm)	1993-01	-2.0	-1.8	1993-06	-1.5	-1.2	1993-12	-0.5	-0.2	1994-06	0.5	0.2	1994-12	1.0	0.8	1995-06	0.5	0.5	1995-12	0.2	0.1	1996-06	0.5	0.4	1996-12	0.8
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Diagnostic C001 (mission e2)

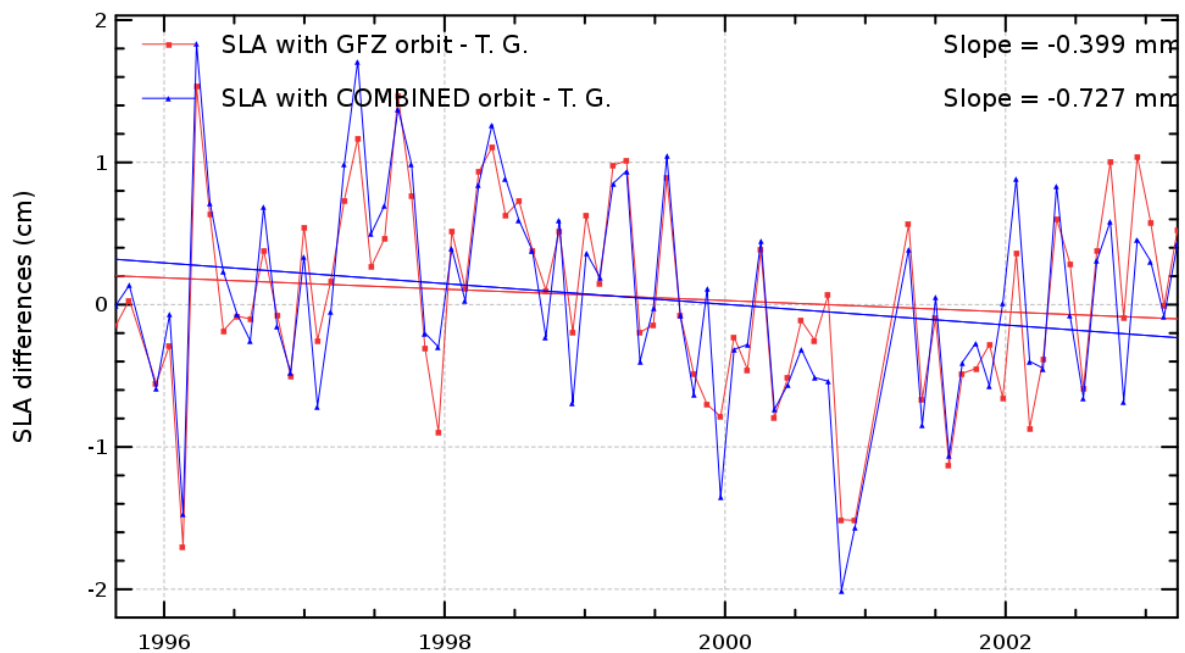
Name : Temporal evolution of SSH differences between tide gauges and altimetry measurements

Input data : Tide gauges SSH measurements

Description : The temporal evolution of global statistics (mean, variance, slope) of SSH differences between tide gauges and altimeter measurements are calculated from a cyclic way (altimeter repetitivity) using successively both altimetric components in SSH calculation. The altimetric and tide gauges data are colocated with criteria of maximum of correlation, and tide gauges used are derived from global networks (GLOSS/CLIVAR, REFMAR).

Diagnostic type : Altimetry and in-situ data comparison

SLA differences : altimetry measurements - tide gauges
Mission e2, cycles 1 to 84



Diagnostic C002 (mission e1)

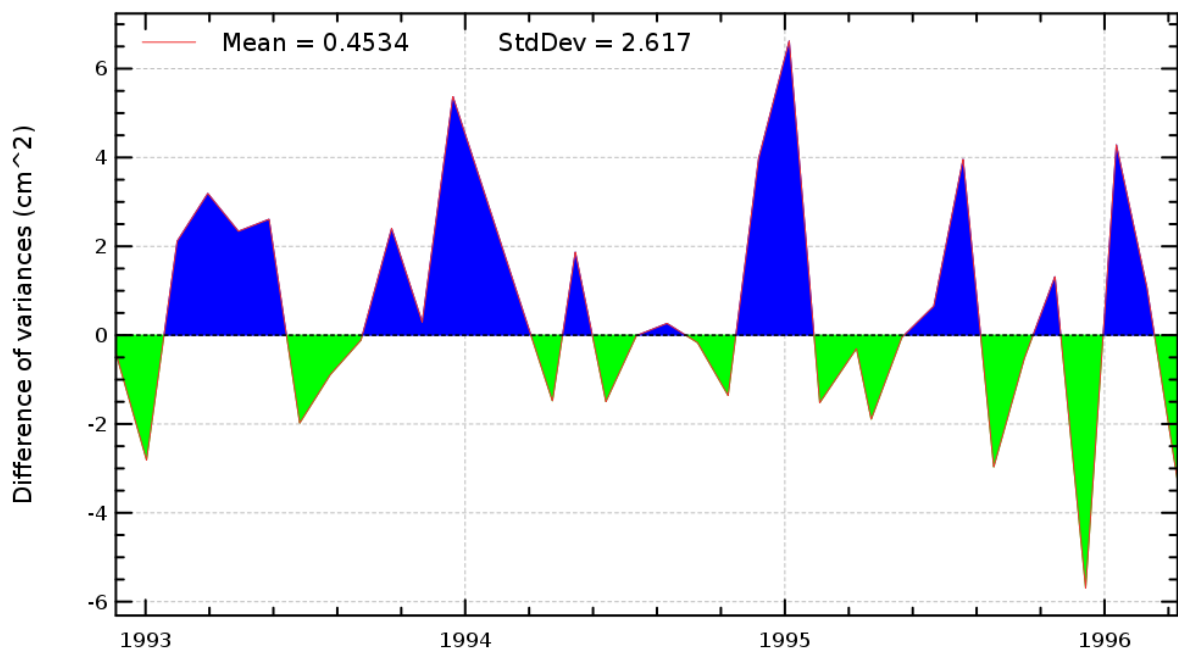
Name : Differences of temporal evolution of SSH differences between tide gauges and altimetry measurements

Input data : Tide gauges SSH measurements

Description : The difference between temporal evolution of global statistics of differences between tide gauge and altimeter data differences are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in altimetric SSH calculation. The altimetric and tide gauges data are collocated with criteria of maximum of correlation, and tide gauges used are derived from global networks as GLOSS/CLIVAR.

Diagnostic type : Altimetry and in-situ data comparison

Difference of variances : $\text{VAR}(\text{SLA with GFZ orbit} - \text{T. G.}) - \text{VAR}(\text{SLA with COMBINED orbit} - \text{T. G.})$
Mission e1, cycles 15 to 53



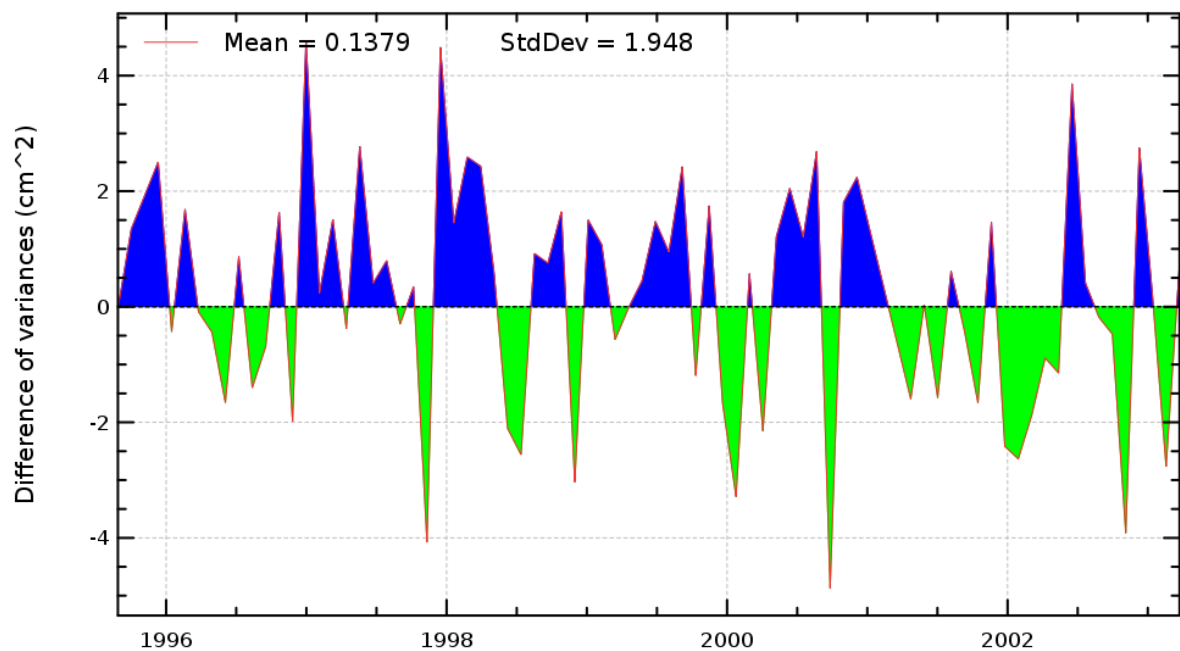
Diagnostic C002 (mission e2)

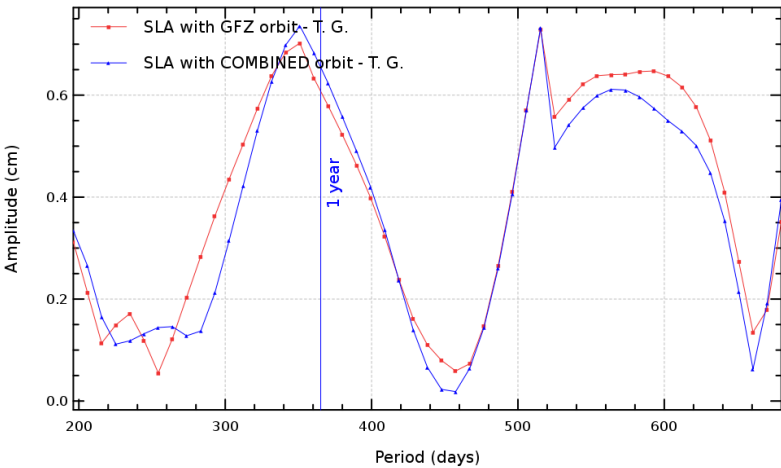
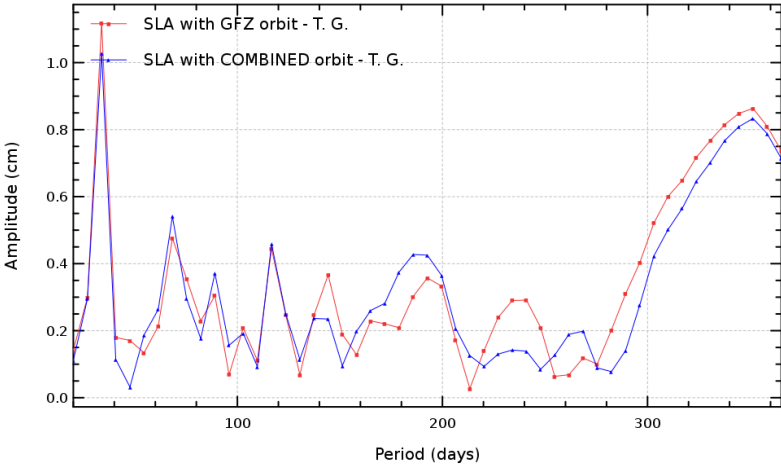
Name : Differences of temporal evolution of SSH differences between tide gauges and altimetry measurements

Input data : Tide gauges SSH measurements

Description : The difference between temporal evolution of global statistics of differences between tide gauge and altimeter data differences are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in altimetric SSH calculation. The altimetric and tide gauges data are collocated with criteria of maximum of correlation, and tide gauges used are derived from global networks as GLOSS/CLIVAR.

Difference of variances : $\text{VAR}(\text{SLA with GFZ orbit} - \text{T. G.}) - \text{VAR}(\text{SLA with COMBINED orbit} - \text{T. G.})$
Mission e2, cycles 1 to 84



Diagnostic C003 (mission e1)	
Name : Periodogram derived from temporal evolution of SSH differences between tide gauges and altimetry	
Input data : Tide gauges SSH measurements	
Description : The periodogram derived from temporal evolution of altimetric and tide gauges SSH differences is calculated using successively both altimetric components in the altimetric SSH. The periodogram is calculated from the mean or variance statistics and it can be displayed for all the whole time period or a dedicated one	
<div>Periodogram of SLA differences : altimetry measurements - tide gauges (ref. period = 1 year) Mission e1, cycles 15 to 53</div>  <div>Periodogram of SLA differences : altimetry measurements - tide gauges (period = [0, 1 year]) Mission e1, cycles 15 to 53</div> 	

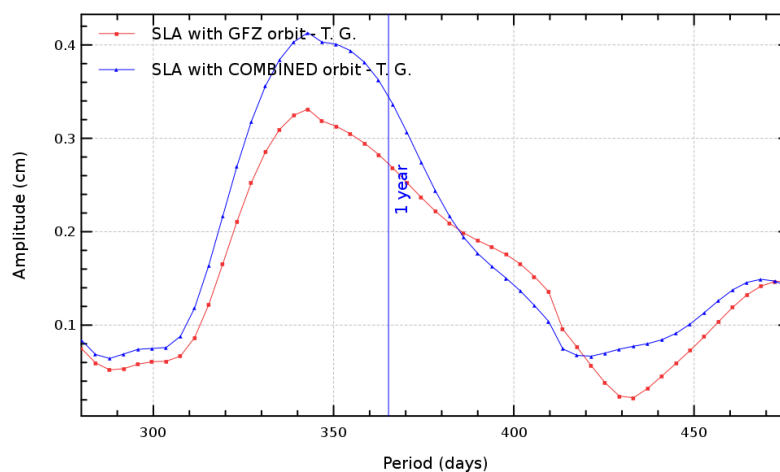
Diagnostic C003 (mission e2)

Name : Periodogram derived from temporal evolution of SSH differences between tide gauges and altimetry

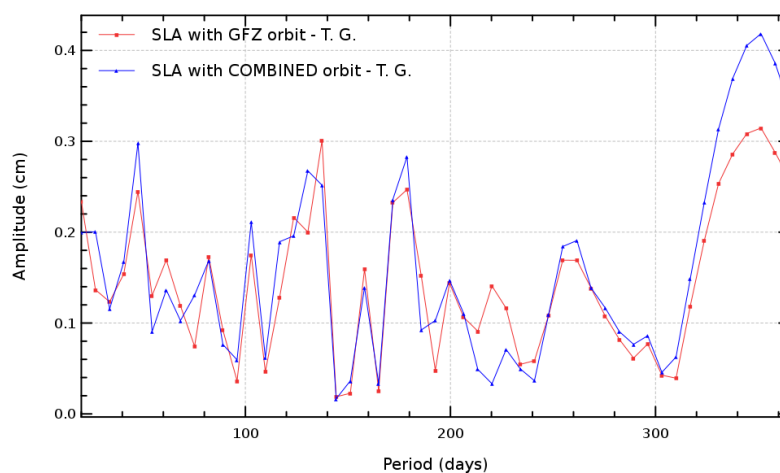
Input data : Tide gauges SSH measurements

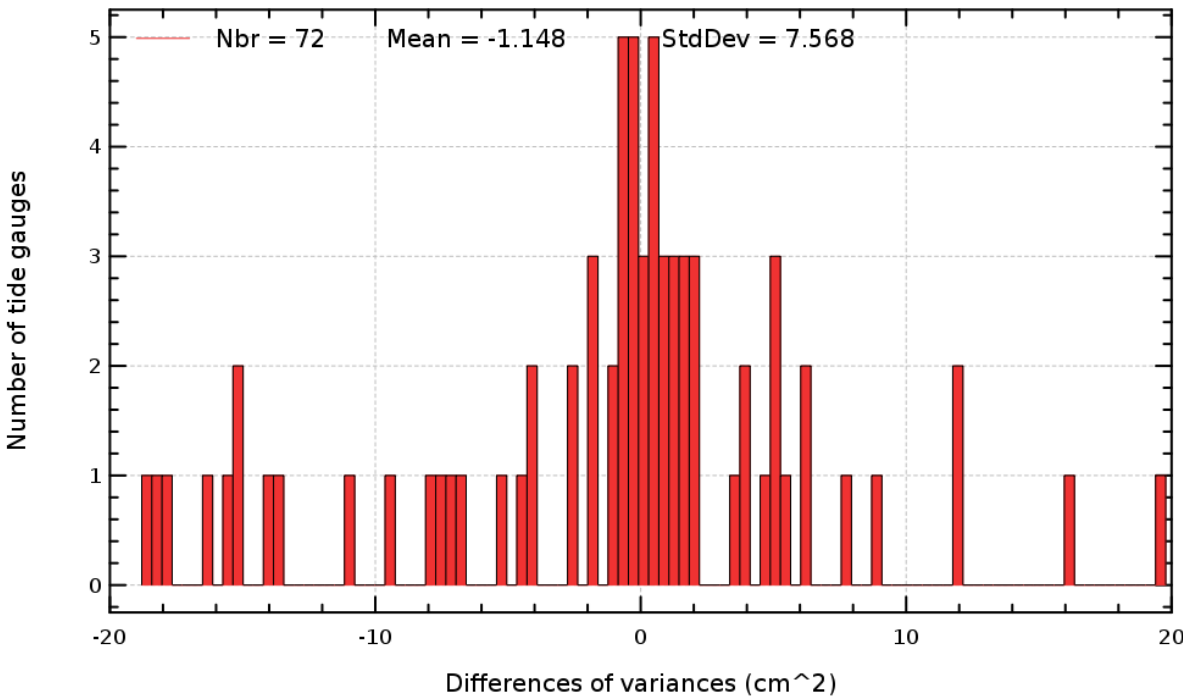
Description : The periodogram derived from temporal evolution of altimetric and tide gauges SSH differences is calculated using successively both altimetric components in the altimetric SSH. The periodogram is calculated from the mean or variance statistics and it can be displayed for all the whole time period or a dedicated one

Periodogram of SLA differences : altimetry measurements - tide gauges (ref. period = 1 year)
Mission e2, cycles 1 to 84



Periodogram of SLA differences : altimetry measurements - tide gauges (period = [0, 1 year])
Mission e2, cycles 1 to 84



Diagnostic type : Altimetry and in-situ data comparison	Diagnostic C004 (mission e1)																																																																														
	Name : Histograms of differences between tide gauges and altimeter SSH differences																																																																														
	Input data : Tide gauges SSH measurements																																																																														
	Description : The difference of histograms between altimeter and tide gauge SSH differences is computed from the elementary statistics (mean, variance) at each tide gauge using successively both altimetric components in the altimetry SSH.																																																																														
	<p>istogram of the difference of variances : VAR(SLA with GFZ orbit - T. G.) - VAR(SLA with COMBINED orbit Mission e1, cycles 15 to 53</p>  <table><caption>Histogram Data (Estimated)</caption><tr><th>Differences of variances (cm^2)</th><th>Number of tide gauges</th></tr><tr><td>-18</td><td>1</td></tr><tr><td>-17</td><td>1</td></tr><tr><td>-16</td><td>1</td></tr><tr><td>-15</td><td>1</td></tr><tr><td>-14</td><td>2</td></tr><tr><td>-13</td><td>1</td></tr><tr><td>-12</td><td>1</td></tr><tr><td>-11</td><td>1</td></tr><tr><td>-10</td><td>1</td></tr><tr><td>-9</td><td>1</td></tr><tr><td>-8</td><td>1</td></tr><tr><td>-7</td><td>1</td></tr><tr><td>-6</td><td>2</td></tr><tr><td>-5</td><td>1</td></tr><tr><td>-4</td><td>2</td></tr><tr><td>-3</td><td>2</td></tr><tr><td>-2</td><td>3</td></tr><tr><td>-1</td><td>2</td></tr><tr><td>0</td><td>5</td></tr><tr><td>1</td><td>5</td></tr><tr><td>2</td><td>3</td></tr><tr><td>3</td><td>3</td></tr><tr><td>4</td><td>3</td></tr><tr><td>5</td><td>1</td></tr><tr><td>6</td><td>2</td></tr><tr><td>7</td><td>1</td></tr><tr><td>8</td><td>3</td></tr><tr><td>9</td><td>2</td></tr><tr><td>10</td><td>1</td></tr><tr><td>11</td><td>1</td></tr><tr><td>12</td><td>2</td></tr><tr><td>13</td><td>0</td></tr><tr><td>14</td><td>0</td></tr><tr><td>15</td><td>1</td></tr><tr><td>16</td><td>0</td></tr><tr><td>17</td><td>1</td></tr><tr><td>18</td><td>0</td></tr><tr><td>19</td><td>1</td></tr></table>		Differences of variances (cm^2)	Number of tide gauges	-18	1	-17	1	-16	1	-15	1	-14	2	-13	1	-12	1	-11	1	-10	1	-9	1	-8	1	-7	1	-6	2	-5	1	-4	2	-3	2	-2	3	-1	2	0	5	1	5	2	3	3	3	4	3	5	1	6	2	7	1	8	3	9	2	10	1	11	1	12	2	13	0	14	0	15	1	16	0	17	1	18	0	19
Differences of variances (cm^2)	Number of tide gauges																																																																														
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Diagnostic C004 (mission e2)

Name : Histograms of differences between tide gauges and altimeter SSH differences

Input data : Tide gauges SSH measurements

Description : The difference of histograms between altimeter and tide gauge SSH differences is computed from the elementary statistics (mean, variance) at each tide gauge using successively both altimetric components in the altimetry SSH.

Histogram of the difference of variances : $\text{VAR}(\text{SLA with GFZ orbit} - \text{T. G.}) - \text{VAR}(\text{SLA with COMBINED orbit})$
Mission e2, cycles 1 to 84

